INDUSTRIAL ARTS and VOCATIONAL EDUCATION

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No. 7

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VACATION DAYS

The annual vacation period is again with us. Many might wish that economic conditions were different than they are. Yet, there is nothing that the individual can do about them. Human beings are adaptable, however, and so most teachers will find that a little careful planning will give them much enjoyment, relaxation, and probably education, even though the financial *status quo* may be at low ebb.

No matter how our readers spend their vacations, INDUSTRIAL ARTS AND VOCATIONAL EDUCATION wishes them an enjoyable and profitable time.

IN THIS ISSUE

Again, INDUSTRIAL ARTS AND VOCATIONAL EDUCATION is presenting projects which may be found helpful to camp directors who include shopwork in their programs.

The flat bow described in the last issue will need a bowstring, and W. Ben Hunt tells how to make one.

Terence Vincent contributes an article on a monoplane which will tax the ability of the boy, while holding his interest and attention until the model has been finished.

E. M. Wyatt, the author of a fascinating book on puzzles, contributes the solution of one of his most perplexing shuffle puzzles.

The "22-Inch Model Knockabout" by E. A. Ferns will please almost any boy. The very explicit instructions which accompany the plans make the building of the model a comparatively easy job.

The other articles by Tibbitts, Feuerstein, Landis, and Herd will be found excellent for summer-school discussion, while those by Hobbs, Manzer, and Wyatt are excellent for those teachers who are looking for related-subjects material.

THIS MONTH'S COVER

The picture chosen for the July cover shows one of the machine shops of the Lane Technical High School, Chicago, Illinois. The equipment in this room consists of twenty-three 11-in. underneath-belt motor-driven lathes.

Articles Indexed—The articles contained in the Magazine are regularly indexed in "The Reader's Guide to Periodical Literature," and "Education Index."

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Editorial Contributions—The Editor invites contributions bearing upon Industrial Arts, Vocational Education, and related subjects. Manuscripts, drawings, projects, news, etc., should be sent to the Publication Office in Milwaukee. Contributions are paid for at regular space rates. In all cases manuscripts should be accompanied by full return postage.

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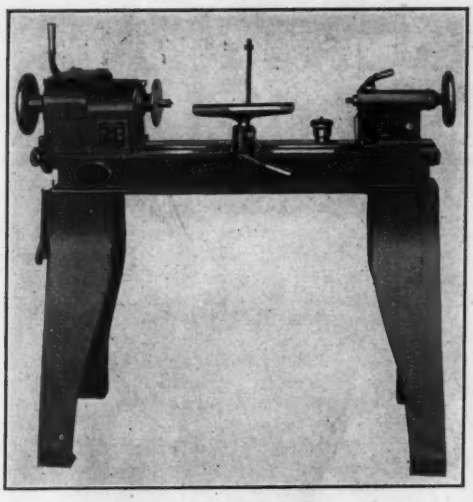
INDUSTRIAL MACHINES BUILT STUDENT SIZE



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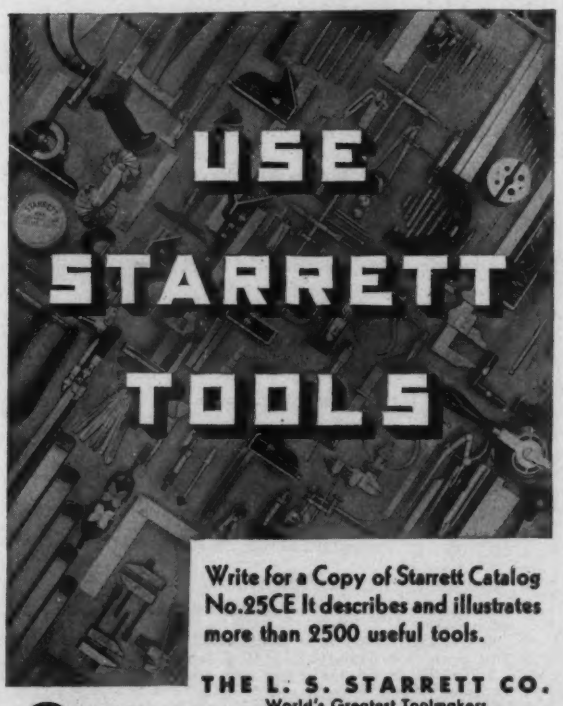

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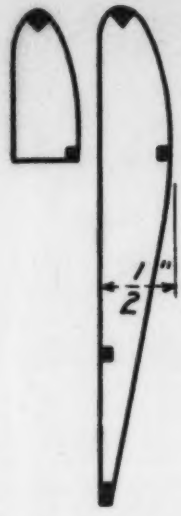
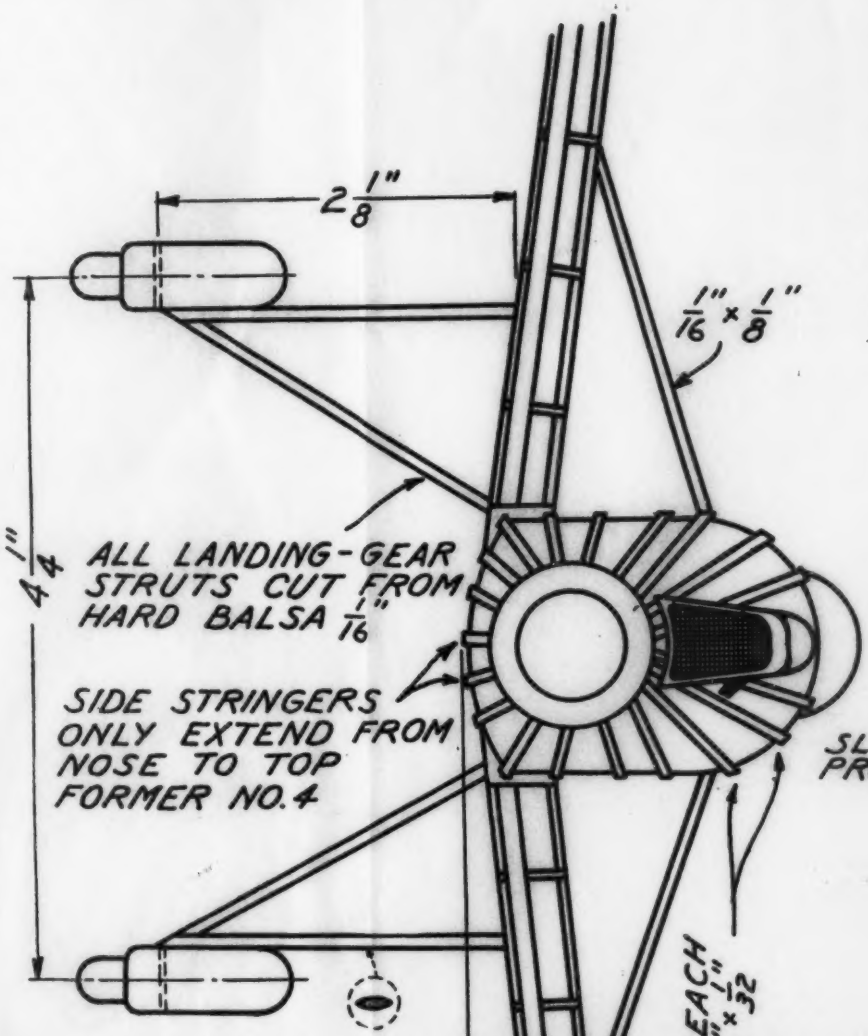
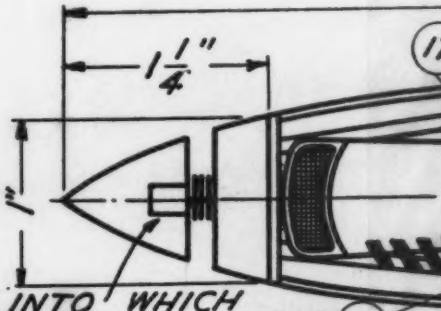
A MONOPLANE
THE HARDESTY SPECIAL

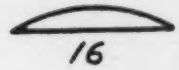


10 MAIN RIBS
8 NOSE RIBS

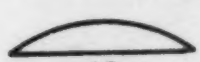

2 1/8"
1/16" x 1/8"
4 1/4"
ALL LANDING-GEAR STRUTS CUT FROM HARD BALSA 1/16"
SIDE STRINGERS ONLY EXTEND FROM NOSE TO TOP FORMER NO. 4
FIVE STRINGERS ON EACH SIDE OF FUSELAGE 1/16" x 1/32"

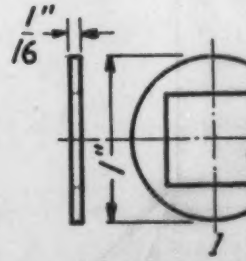


WING FILLET CUT TO



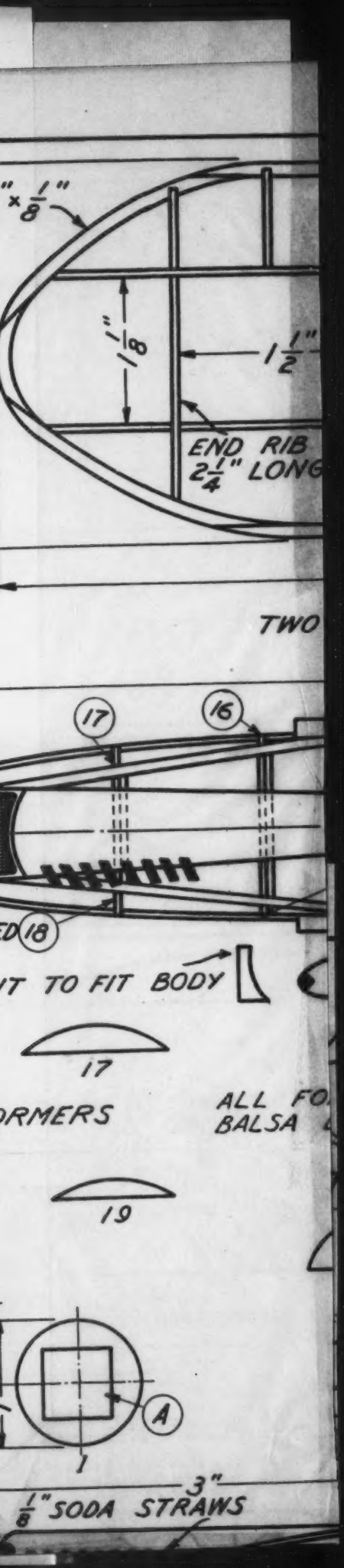
SIDE FORMERS





SOFT BALSA HOLLOWED

1/8" SOD


1/8" x 1/8"
1/8"
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END RIB
2 1/4" LONG
TWO
17
16
18
IT TO FIT BODY
17
ORMERS
ALL FO
BALSA
19
A
1
3"
1/8" SODA STRAWS

1 1/2"
8 1/4"
WANTED - ONE LEFT
EXCEPT NO. 1
TOP
2
3
6
"D" L
REED

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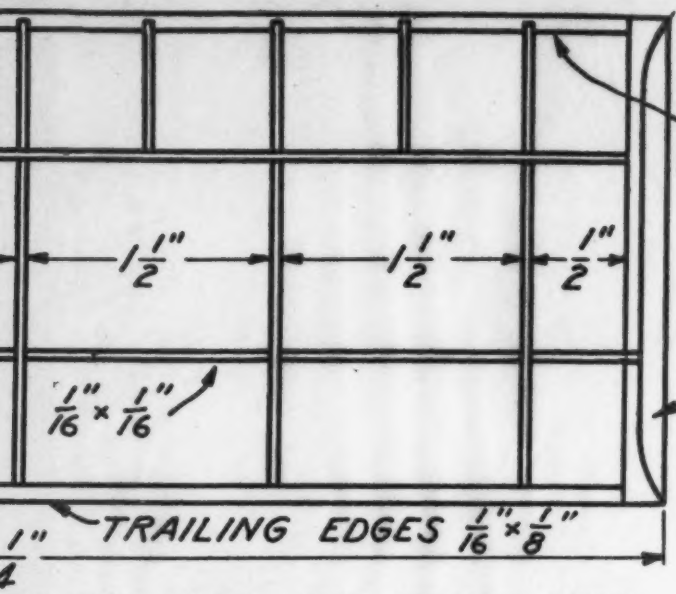
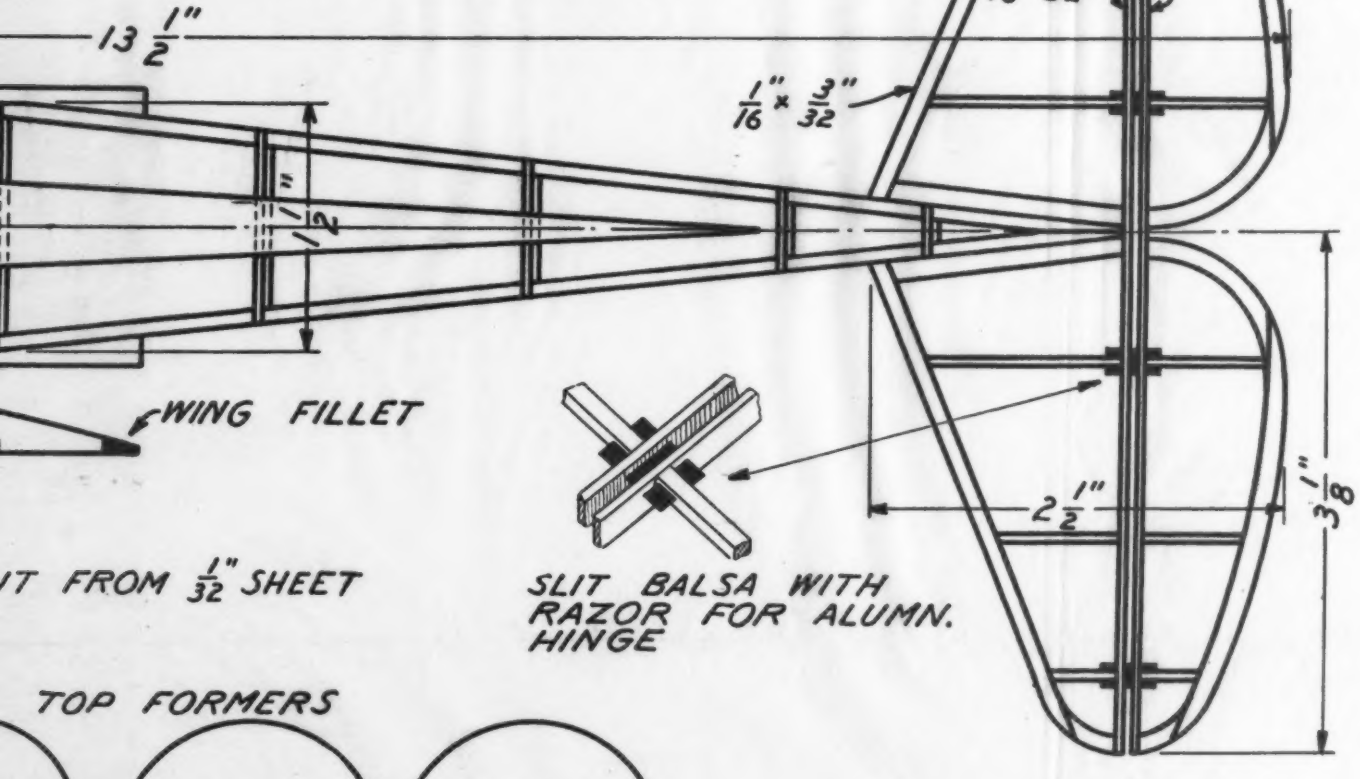


SCALE
FULL SIZE

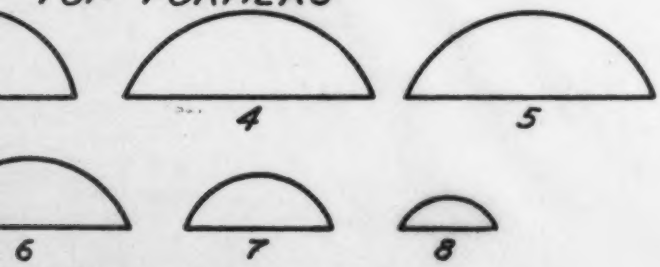
1/4" LEFT HAND, ONE RIGHT HAND



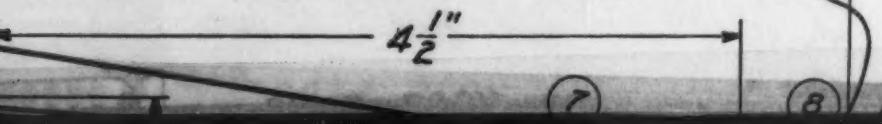
IT FROM 1/32" SHEET

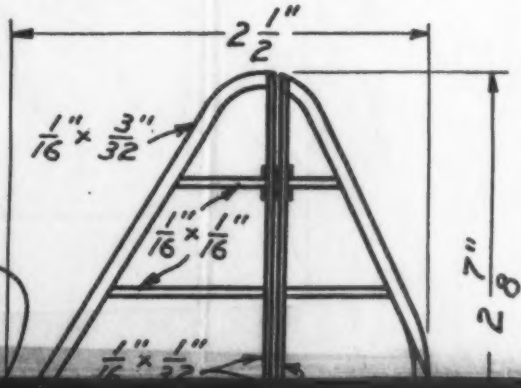
SLIT BALSA WITH RAZOR FOR ALUMN. HINGE

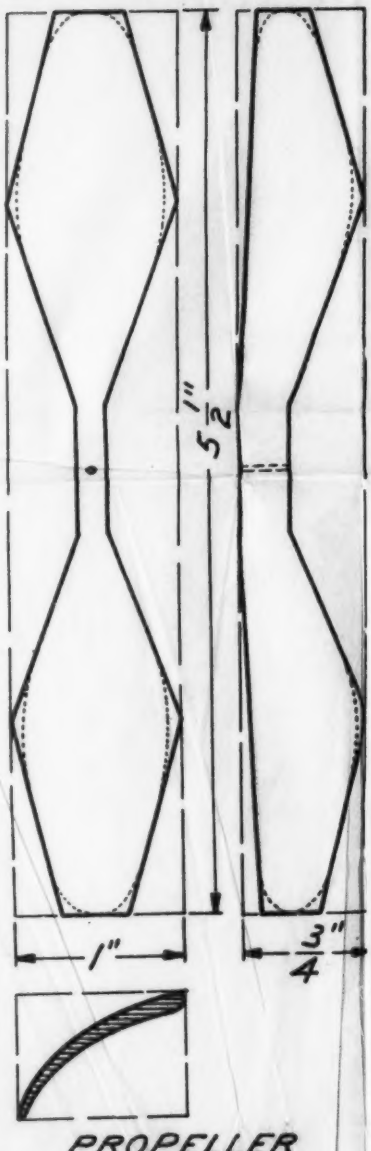
TOP FORMERS

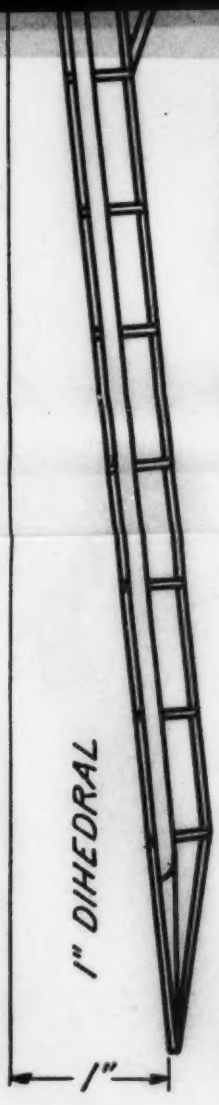


"D" LEFT UNCOVERED TO ATTACH MOTOR "C"

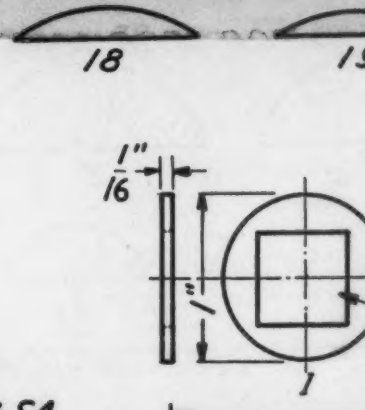


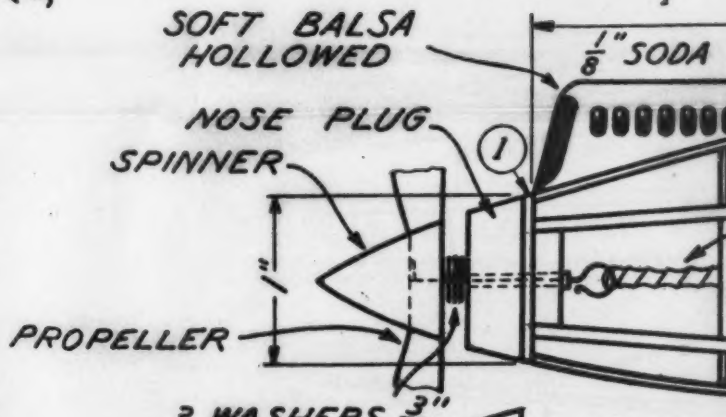


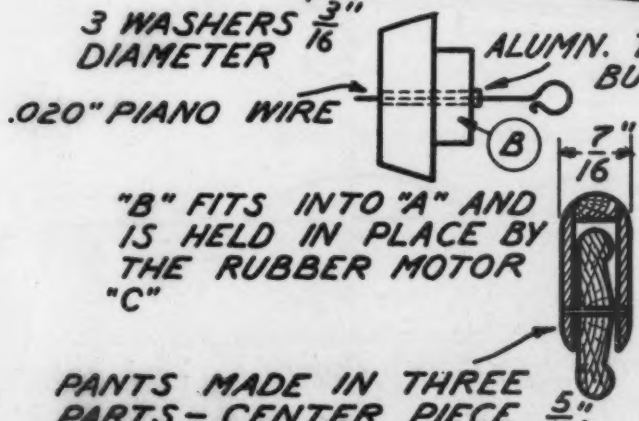




FIVE STRINGERS ON SIDE OF FUSELAGE



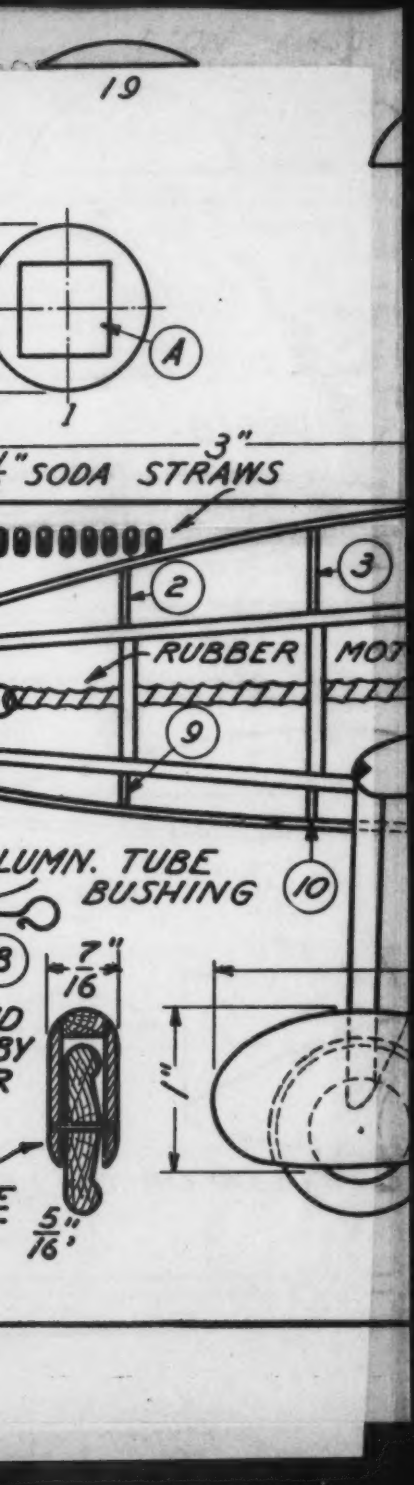




"B" FITS INTO "A" AND IS HELD IN PLACE BY THE RUBBER MOTOR "C"

PANTS MADE IN THREE PARTS – CENTER PIECE 5/16", SIDE PIECES 1/16"

Submitted by Terence Vincent, Los Angeles, California


19
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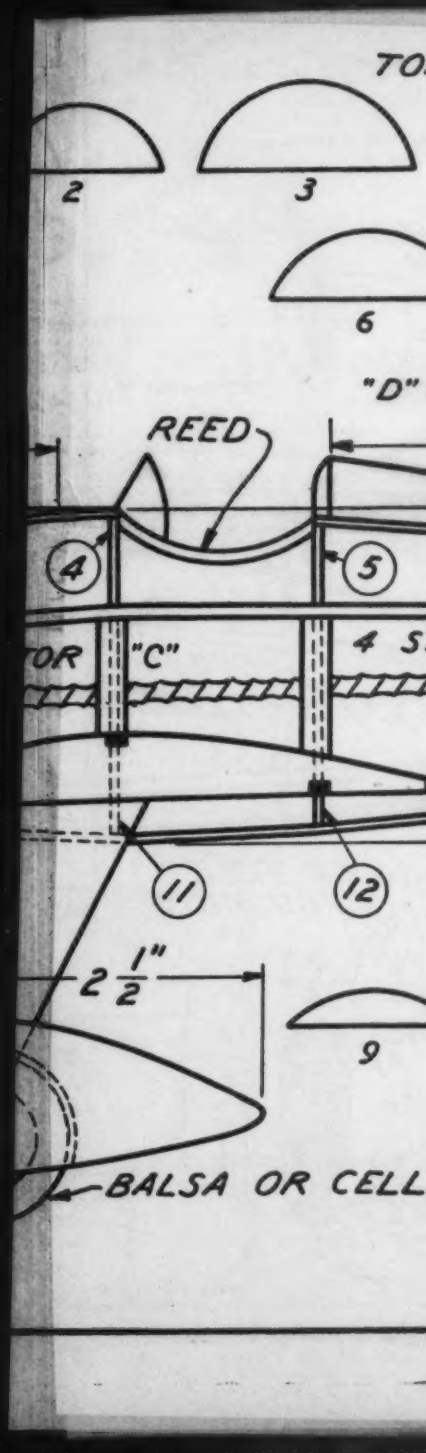
16


TO
2
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OR
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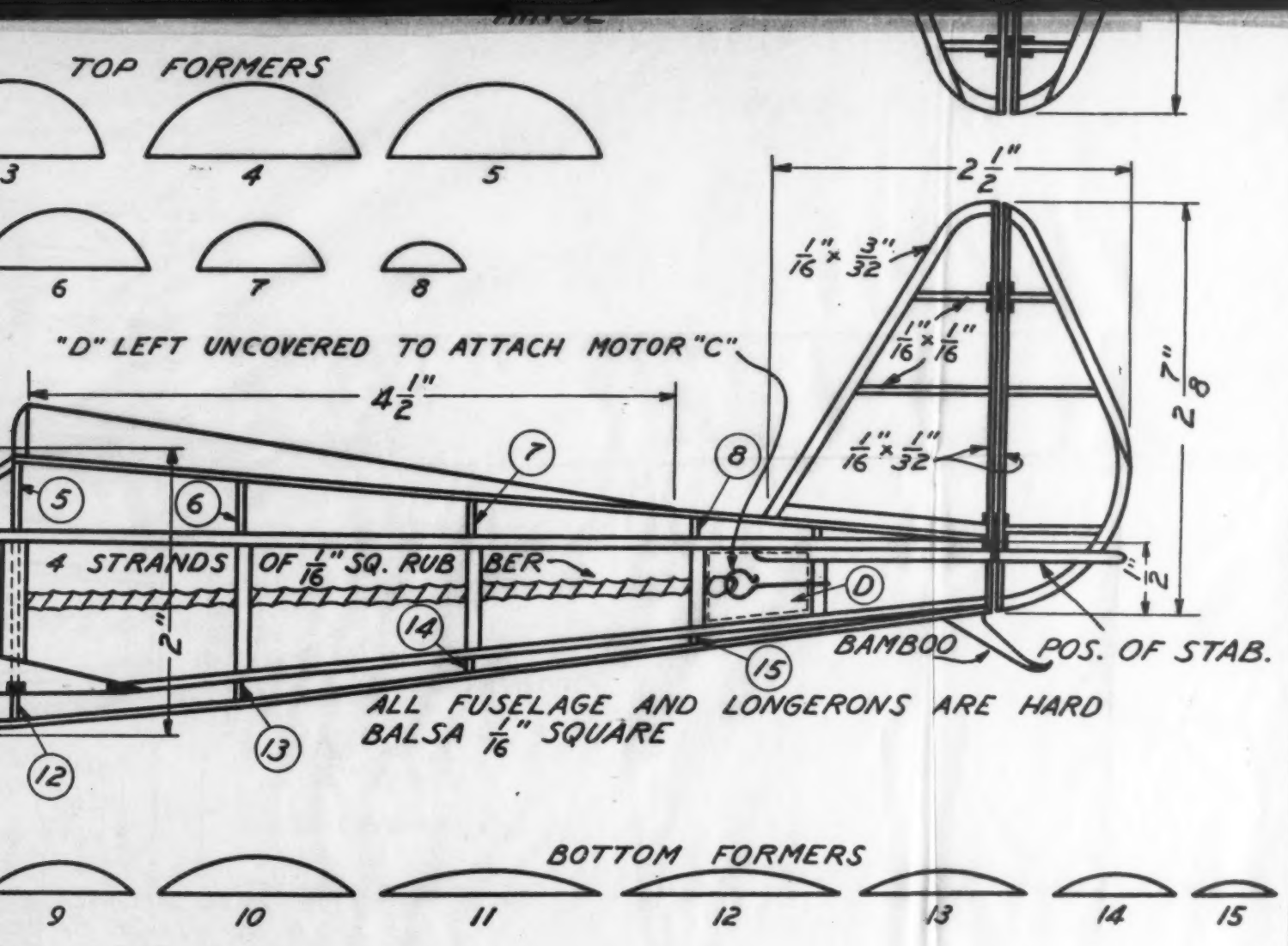
BALSA OR CELL



(This article is described on page 213)

July, 1935
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INDUSTRIAL ARTS and VOCATIONAL EDUCATION

Functions of Co-ordination—I

F. Lyman Tibbitts

Oklahoma City University,
Oklahoma City, Oklahoma

A comprehensive and thorough study of the functions served by co-ordination in continuation-school work.

A CLEAR-CUT understanding of the functions that should be served by a co-ordination program in continuation education would seem necessary to the further development of this type of education. Various opinions have been expressed in both theory and practice, but little agreement has been reached in either case. In view of this fact, the writer has studied the functions from three points of view: (1) the literature dealing with co-ordination in part-time or continuation education was reviewed for the purpose of discovering the functions and activities set up by the authorities; (2) conferences were held with a great many principals and co-ordinators in order that current practices might be known, and (3) a check list containing 7 major and 45 minor functions was submitted to 12 experts and 70 teachers and co-ordinators for their evaluation of the activities. The values were expressed in terms of very important, important, and not important.

Functions Expressed in Literature

The literature dealing with the problem of co-ordination is none too plentiful at best. Aside from one bulletin issued by the University of California, and one section of a research study (unpublished) in San Francisco, the literature on the subject of co-ordination is limited to a few short paragraphs found here and there in the general literature dealing with part-time or continuation education.

Noall,[1] in his definition of co-ordination, gives an analysis of co-ordination in the following language:

> Co-ordination is that activity in part-time school through which the teachers become acquainted with the problems of the home, the job, and the social life of the pupils. It involves visitation to the homes, the place of employment, observation of the pupils at work, and the study of the various factors and influences that enter into the pupils' lives. Through these activities the pupils' needs are learned and the real problems of the part-time school are discussed.
>
> A knowledge of the home and employment problems will provide common interest between the teacher and pupil, will be the basis for guidance and placement, and the development of an instructional program. The acquaintance with the parent and employer and their co-operation will reinforce the position of the teacher in his relation to the pupil.

Dr. Edwin R. Snyder, former commissioner of Vocational Education of California, in a foreword,[2] outlines the functions to be performed in co-ordination as follows:

> The degree of success or failure of part-time education for minors depends primarily upon the degree of success or failure of the system of co-ordination maintained by local school authorities.
>
> At the present time school officials do not know sufficiently well the fields of employment to enable them to establish and maintain the best types of instruction for part-time pupils. Co-ordination should gather this.
>
> Likewise, employers are not informed concerning the possible opportunities for practical instruction that may be provided for their employees by modern school systems. Co-ordination should give this information.
>
> The parents of working boys and girls are, for the most part, uninformed of the real demands for efficient educative service in the various occupations. This information should be given them by the co-ordinators.
>
> The school experience of employers and parents is too remote to form a proper basis for intelligent opinion concerning the possibilities of the public-school system for modern social service. In short, the people have not yet been wholly convinced that the public-school system can do a practical job in a practical manner. The co-ordinator must market part-time education.
>
> The schoolwork of the pupil must be chosen with a view to capitalizing his occupational, home, and other social experiences. All of these influences should be welded together in order that experience may be made a real educational force, and schooling a real training for social service. Who other than the co-ordinator can perform this service?
>
> The part-time act states that local authorities, "Shall provide for individual council and guidance in social and vocational matters for each pupil enrolled in these classes."
>
> The performance of this duty requires a knowledge of the home, working, and recreational conditions of the boys and girls. How can this information be secured except through the thorough-going system of co-ordination?

The San Francisco Continuation High School[3] sets up five major objectives to be accomplished by co-ordination: (1) to secure for the school the good will, interest, and co-operation of pupils, parents, and employers; (2) to promote regular attendance and punctuality on the part of pupils; (3) to guide pupils in educational, vocational, and social fields; (4) to obtain proper employment for part-time high-school pupils, and (5) to obtain and report desirable data for case histories, identification cards, etc.

Margaret Alltucker[2] selects the following major functions for co-ordination service: (1) educational salesmanship, (2) promoting instruction, (3) placement, (4) personal advice and assistance, and (5) community co-operation.

A California State Committee[4] on Part-Time Education, of which the author was an *ex officio* member, received a report from the subcommittee on co-ordination in which the

[1] Noall, Irvin S., "Report of Special Investigation of Part-Time Education in Small Communities in California, with Recommendations for Improvement." Unpublished study, Division of Vocational Education, University of California, Berkeley, Calif.

[2] Alltucker, Margaret M., *Co-ordination in Part-Time Education*. University of California publication, Part-Time Education Series No. 4, Bulletin No. 3.

[3] Bulletin No. 5, *The Part-Time High School*. Department of Research, San Francisco Public Schools, San Francisco, Calif.

[4] The Subcommittee on Co-ordination submitted a report from which this is taken. This is unpublished.

functions of co-ordination were listed as: (1) assisting the director in curriculum development; (2) supervising instruction at the place of employment according to specific agreement; (3) co-operating with the follow-up workers in evaluating the program; (4) surveying and analyzing work situations; (5) keeping records and making reports on visits; (6) executing agreements with parents and employers, and (7) investigating and making recommendations on requests for exemptions.

The author's analysis of the major functions of co-ordination also falls under seven heads which are very similar to those worked out by the subcommittee. These major functions are: (1) preparing and directing publicity work; (2) making visits to homes of pupils; (3) making visits to employers of part-time high-school pupils; (4) placing and maintaining pupils in proper employment; (5) rendering larger community service; (6) enriching the curriculum with materials brought in from the field, and (7) holding conferences with other teachers regarding pupils under their instruction. An eighth item used in the study was miscellaneous services which the co-ordinator might render for the school and the pupil.

Publicity

Publicity is one of the very important factors in the sale of part-time education to the pupil and the community. Without hearty co-operation on the part of the community as a whole, and without a good general understanding of the purposes of part-time education, the work of the continuation or part-time school must fall far short of its possibilities. Publicity in part-time education may be divided into three phases: (1) the preparation of articles for papers and magazines; (2) the delivering of talks before clubs and societies in the community, and (3) the preparation of reports for publicity as well as official records:

An analysis of Table I shows that of the 70 teachers and co-ordinators in the four systems, San Francisco, Berkeley, San Jose, and Sacramento, 30 per cent rank the preparation of articles for papers and magazines as very important, 40 per cent gave this item a rating of important, and 17 per cent rated it as not important. Of the experts, 9 per cent ranked it as very important, 25 per cent as important, and 67 per cent as not important. Thus the teachers would give this item a rank of importance and the experts would give a rank of no importance so far as the co-ordinator is concerned.

To item No. 2, making talks to clubs, was given a rank of very important by 49 per cent of the teachers and 50 per cent of the experts, thus according a rank of very important to this item.

TABLE I. Showing Vote on Importance of Certain Publicity Services in Percentages

Activities	*Very Important*	*Important*	*Not Important*
1. Preparation of articles for papers, etc.			
Total Teachers	*40**	40	17
Total Experts	9	*25*	*67*
2. Making talks to clubs and public meetings.			
Total Teachers	*49*	43	6
Total Experts	*50*	42	9
3. Preparing reports for publication.			
Total Teachers	31	*41*	14
Total Experts	17	*50*	33

The preparation of reports for official use was given a rank of very important by 31 per cent of the teachers and 17 per cent of the experts. It was rated important by 41 per cent of the teachers and 50 per cent of the experts while it was rated of no real importance by 14 per cent of the teachers and 33 per cent of the experts. Evidently the item is important but not significantly so.

Considering the general function of publicity in the light of the ratings given, it is rated as not important among the 7 major activities. This may be due, in part, to the fact that part-time education has been quite well sold to the public in the State of California.

*Highest percentages are italicized to facilitate reading.

Visiting the Homes

When the opinions of both teachers and experts are summarized, the function of home visitation ranks as important among the seven major activities of co-ordination. The stress given to this item in the literature on co-ordination would lead one to reach a similar conclusion. That this is important none will deny, but how much it means in actual practice no one seems aware.

As shown in Table II, there are ten different things that co-ordination of the school, pupil, and home should seek to accomplish. In order of importance, according to the rating of teachers and experts, the activities are:

1. To encourage attendance at school.
2. To get contacts for developing pupil interest.
3. To discover the pupil's environment.
4. To secure information for vocational guidance.
5. To secure better co-operation of the home.
6. To correct misunderstandings about the school.
7. To interpret the part-time-school laws.
8. To secure information for social guidance.
9. To secure information for educational guidance.
10. To secure information for moral guidance.

All of the items set forth above were given a rank of very important by both teachers and experts, with the exception of items 8, 9, and 10, which were ranked as only important by the experts.

An examination of Table II will give the reader a good picture of the importance attached to these activities. The teachers place more stress upon attendance, the correcting of misunderstandings, the development of pupil interest, moral guidance, and vocational-guidance factors, while the experts place more emphasis upon the securing of contacts for the development of pupil interests, the discovery of the pupil's environment, and the securing of better co-operation of the home. The encouragement of attendance and correcting misunderstandings were also very important in the eyes of the experts.

Table II shows that 91 per cent of the teachers and 58 per cent of the experts gave encouragement of attendance a rank of very important. Nine per cent of the teachers and 25 per cent of the experts gave this item a rating of important, and none of the teachers and 17 per cent of the experts stated that the item was not important.

Seventy-nine per cent of the teachers and 83 per cent of the experts rated the getting of contacts for developing pupil interest as very important, 14 per cent of the teachers and 8 per cent of the experts gave the item a rating of important, and 6 per cent of the teachers and 8 per cent of the experts gave this activity a rating of not important.

The discovery of the pupil's environment ranked not important among the ten items. Seventy-four per cent of the teachers and 75 per cent of the experts gave it a ranking of very important, 21 per cent of the teachers and 25 per cent of the experts ranked it as important, and only 3 per cent of the teachers and none of the experts thought that the item was not important. Thus, the two groups agree in their consideration of this point.

The securing of information for vocational guidance ranked with the first five items in the list of ten. Evidently all feel that there is much to be found in the pupil's environment which will contribute toward the vocational-guidance problem. Seventy per cent of the teachers and 50 per cent of the

TABLE II. Showing the Percentage of Votes on the Rate of Importance of the Five Most Important Activities Connected with Home Visitation

Activities	Very Important	Important	Not Important
1. To encourage pupil's school attendance.			
Total Teachers	91	9	0
Total Experts	58	25	17
2. To get contacts for developing pupil interest.			
Total Teachers	79	14	6
Total Experts	83	8	8
3. To discover the pupil's environment.			
Total Teachers	74	21	3
Total Experts	75	25	0
4. Secure information for vocational guidance.			
Total Teachers	70	26	3
Total Experts	50	33	17
5. To secure better home cooperation.			
Total Teachers	54	14	0
Total Experts	67	33	0
6. Correct misunderstandings about the school.			
Total Teachers	80	14	1
Total Experts	58	17	25
7. Interpret the part-time-school law.			
Total Teachers	66	31	3
Total Experts	42	33	25
8. Secure information for social guidance.			
Total Teachers	61	30	6
Total Experts	33	50	0
9. Secure information for educational guidance.			
Total Teachers	61	33	3
Total Experts	17	75	0
10. Secure information for moral guidance.			
Total Teachers	79	16	6
Total Experts	25	50	8

experts rated the item very important, 26 per cent of the teachers and 33 per cent of the experts rated the item important, and 3 per cent of the teachers and 17 per cent of the experts indicated that the activity was not important in coordination service. Evidently, teachers see more vocational-guidance material in the pupil's environment than the experts.

Securing the hearty co-operation of the home is also one of the five most important activities of the co-ordinator, according to the investigation. This has been emphasized in the literature as well as in practice. Fifty-four per cent of the teachers and 67 per cent of the experts ranked this item as very important, 14 per cent of the teachers and 33 per cent of the experts ranked the item important, and none of the teachers or experts ranked it as not important.

The next five items found in Table II are of somewhat less importance as compared with the first five. However, item 6, correcting misunderstandings about the school, ranks about on a par with the last two in the first five. Here 80 per cent of the teachers and 58 per cent of the experts gave the activity a rating of very important, 14 per cent of the teachers and 17 per cent of the experts ranked it important, and 1 per cent of the teachers and 25 per cent of the experts rated the item as of no importance. It is observable that the teachers gave this activity a much higher rating than did the experts. It is probable that they have encountered the problem more frequently than have the specialists. The item falls in the lower five because of the low rating of the experts.

The interpretation of the part-time-school law is of considerable importance as viewed by both teachers and experts. Sixty-six per cent of the teachers and 42 per cent of the experts ranked the item very important, 31 per cent of the teachers and 33 per cent of the experts ranked the item important, and 3 per cent of the teachers and 25 per cent of the experts rated it as not important.

The eighth item of importance, according to the vote of the teachers and experts combined, is the securing of information for social guidance. The teachers place more stress on this point than the experts. Sixty-one per cent of the teachers and only 33 per cent of the experts gave this item a ranking of very important, 30 per cent of the teachers and 50 per cent of the experts ranked the activity only important, and 6 per cent of the teachers and none of the experts felt that the item was not important.

Neither teachers nor experts feel that there is much in the pupil's home environment which will contribute to educational guidance. The evidence supporting this fact is that only 61 per cent of the teachers and 17 per cent of the experts felt that securing information for educational guidance was very important in home visitation. Thirty-three per cent of the teachers and 75 per cent of the experts rated this activity as important, and 3 per cent of the teachers and none of the experts felt that this item was of no importance. In other words, it is rated as important when it would appear to be very important in an educational program.

The securing of information for moral guidance of the pupil is the least important of the ten activities of co-ordinators in their home visitation. The teachers, however, place the item third place in the rank of the ten, while the experts place it last with considerable majority. In other words, 79 per cent of the teachers rank the item very important, and only 25 per cent of the experts give it this rating. Sixteen per cent of the teachers rank the item as important, and 50 per cent of the experts give it this rating, while 6 per cent of the teachers and 8 per cent of the experts gave it a rating of no importance.

(To be continued)

A Challenge to Shop Teachers

Arthur Feuerstein

President, Connecticut Industrial Arts Association

The author gives an exhortation to his fellow teachers which will bear study and thought.

MANY industrial-arts teachers are becoming concerned over the fact that teachers of other subjects are carrying on various construction projects. They view this as an intrusion upon the sanctity of that portion of the child's education specifically "allotted" to them.

This condition is not by any means a fictitious cause for concern. It is a real problem that all industrial-arts teachers should recognize. Those industrial-arts teachers who are becoming alarmed over this situation might well pause, however, and analyze the factors involved. It is quite possible that after such an analysis is completed, a very vital turn of events will be noted, which will indicate that we are approaching a change

in industrial-arts education quite as significant as that which took place when the single-type formal woodworking shop gave way to the general diversified and unit shops. They may further note trends that point to the opening up of possibilities that may lead to a different conception of the responsibilities of the industrial-arts teacher, trends that will place him in a position of increasing importance, if he but recognizes his professional opportunity and is ready to meet the challenge.

What is this challenge? Succinctly, this: Is the industrial-arts teacher ready to take a broader view of education than ever before, and so conduct the industrial-arts work as to make it an interwoven part of the integrated setup of the school?

The change-over from the formal woodworking shop to the general diversified shop has done this to a degree, but for many industrial-arts teachers, the sad commentary prevails that construction of things is still practically their sole concern. The persistence of a majority of the industrial-arts teachers in interpreting adolescent education in terms of projects — be these made of wood or of other materials — instead of in terms of meeting adolescent-life needs, is a contradiction of the aims and purposes of modern education.

The lack of informational materials for the broader consideration of problems; the meagerness of illustrative materials — the frequent absence of even bulletin boards; the barren shop or factory atmosphere; the lack of pupil participation in real managerial activities; and frequently the attitude of the industrial-arts teacher if assigned to duties within the school other than "shopwork," often belie any relationship of the industrial-arts department to the rest of the school.

Industrial-arts teachers must be ready to alter set courses of study, and provide for taking care of individual pupil problems which arise in other subjects if they are to serve the best efforts of the school in general. This does not mean that shop pupils should be exploited for general utility work about the school, but it does mean the educative application of industrial-arts information and techniques to related construction problems which arise in the several academic subjects as an outgrowth of the various situations which the pupils are considering in these subjects.

The English teacher who has Thomas make a miniature setting of Robert Louis Stevenson's "Treasure Isiand" is endeavoring to provide Thomas with an opportunity of expressing his ideas in a way other than by the traditional oral or written report in which Thomas has perhaps manifested no special interest. The teacher who carries on such construction work is interested in construction only to the extent that it serves as a means of enriching, clarifying, or motivating the work of the child. Shopwork, as such, is not in the mind of this teacher.

The various educational doctrines of correlation, co-ordination, co-operation, and integration have progressively worked toward eliminating subject-matter boundaries. The modern teacher whose concern is for the total educational welfare of the child does not hold patent rights to all information and procedures of her subject, nor does she recognize claims to such protection by teachers of other subjects. The days of compartmentalization of subject matter are on the wane. The emphasis of modern teaching is on the total educative values of the experiences to which the children are subjected — and experiences seldom consist of material from one subject-matter field.

Could this miniature setting of "Treasure Island" be carried on in the shop, or with the assistance of the industrial-arts teacher? Would the English teacher consider such a procedure? Would the industrial-arts teacher consider such a procedure?

The answer to these questions when applied to a few cases is obvious. Most teachers will co-operate (which may mean almost anything) and "do what they can," but when these problems are multiplied by a large number of pupils, as is the tendency under the integrated, co-ordinated, and fusion programs, many factors enter the situation that require a definite understanding and an organized procedure on the part of the industrial-arts teacher — and of other teachers — in order to fit in with the smooth operation of the curriculum of the school as a whole, and to serve the best interests of the purposes of education.

If the industrial-arts teacher takes the position that his course of study cannot be altered, the English teacher is going to carry off the construction projects herself, and then the history teacher, the geography teacher, and other teachers are going to follow. Whereas, if the industrial-arts teacher purposefully assumes a responsibility for helping the pupils of these several subjects in doing their various related construction problems, his position becomes vastly more important in its total educational significance, and industrial arts becomes an integral educative agency of the school. Herein lies the opportunity of the industrial-arts teacher to use his ability as a specialist in playing an important part in the modern methods of education and exerting the influence of his instruction beyond the confines of his shop.

Carrying out this procedure, the industrial-arts teacher becomes the expert in technical information and practices and provides the teachers of other subjects with the means of expanding the application of the content of their subject-matter fields. He assists in broadening pupils' experiences by enabling them to carry on more comprehensive projects with considerably more informational content. At the same time the industrial-arts instruction will become correspondingly more meaningful as a direct result of its application to problems and projects which the pupils are carrying on as an integral part of their school program. Industrial-arts work thus takes on an additional meaning and importance because of its total school significance in contrast to its separate- or single-subject significance.

If industrial-arts teachers are to progress along with the modern school, it is necessary that they definitely concern themselves with other subjects besides their own. It is only upon this basis that industrial-arts teachers will be able to retain their rating as educators, and maintain a proper perspective of the educative values of school practices. Where the activities of the industrial-arts department are so interwoven in the very fabric of the school, there can be no cause for alarm that the academic teachers will blur out the design of the industrial-arts department. Where the industrial-arts department fulfills this definite need in the life of the school, the constructional work that might otherwise be carried on by academic teachers becomes superfluous and it dies out because of its needlessness. Rather than become concerned over the intrusion of academic teachers into industrial-arts activities, it would help immeasurably if industrial-arts teachers would become concerned over what is bringing this about, and take steps to make further infringement unnecessary.

A fleet of model boats that suggests interesting possibilities for the school shop. Photo courtesy Delta Manufacturing Company

Instruction-Sheet Rating Scale

Russell H. Landis

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The author presents herewith a useful scale for judging the value of an instruction sheet.

THE use of instruction sheets as a teaching device has been increasing in all branches of education. Instruction sheets find their greatest adaptability in industrial-arts education, and particularly in the general-shop phase of industrial arts.

The success attained by these sheets is largely dependent upon their quality. Whatever the type of instruction sheet, and by whatever name it may be called — job sheet, process sheet, or information sheet — it must conform to certain standards which are recognized as necessary elements of a *good* instruction sheet.

The rating scale presented herewith provides a quick and objective means of estimating the value of any instruction sheet. It is simple and self-explanatory. The selection of the elements comprising the scale was made from a study of numerous articles regarding the subject.

Many teachers prefer to make their own instruction sheets. These teachers can use the rating scale as a guide in the construction of their sheets and thus maintain a uniform high quality in them.

For those who prefer to buy instruction sheets, the rating scale serves as a measuring rule to insure the purchase of the best available instruction sheets.

The scale is applicable to a variety of types of instruction sheets by simply eliminating those items that do not apply to the particular sheet being rated.

For further information regarding the items of the rating scale, or for assistance in constructing instruction sheets, consult the following:

Fryklund, Verne C., "Instruction Sheets and the Principles of Teaching," *Industrial Arts Magazine,* February, 1927, pages 41–44.

Fryklund, Verne C., "Factors Affecting the Use of Instruction Sheets," *Industrial Arts Magazine,* July, 1927, pages 241–243.

Fryklund, Verne C., "The Instructional Unit," *Industrial Arts and Vocational Education,* June, 1933, pages 201–203.

Rodgers, Robert H., "Job Sheets in Vocational Teaching," *Industrial Arts Magazine,* April, 1927, pages 119–121.

Van Westrienen, Harold J., "Preparation and Use of Lesson Sheets," *Industrial Arts and Vocational Education,* July, 1931, pages 237–242.

A RATING SCALE FOR INSTRUCTION SHEETS

Instructions: Rate the instruction sheet on each of the fourteen points below by placing a check mark on the scale at the point which most nearly fits the description. Omit any point which does not fit the type of sheet being used.

1. General appearance	Formal, uninteresting, unattractive, no illustrations. No indentions.	Mediocre. Too much reading matter. Few illustrations. Indentions not distinct.	Interesting, attractive, many illustrations. Reading matter in short paragraphs. Good indentions.
2. Title	General, vague, no hint as to character of instruction. Poorly placed on sheet. Small type.	Doubtful, not clear as to character of instructions. Not placed to best advantage on sheet.	Specific; tells character of instructions. Large type. Well placed on sheet (centered, top of sheet, separated from body).
3. Division into units	No divisions noticeable. No subtitles; all parts run together.	Slight separation of divisions. Subtitles poorly marked and not very noticeable.	Divisions of sheet clearly marked and distinctly separated. Good subtitles.
4. Procedures	No distinct steps. No sequence of operations.	Steps noticeable but not listed. Sequence not entirely clear.	Steps distinctly listed in proper sequence.
5. Instructions	Vague; more than one meaning. Run together. Not numbered. Much extraneous material included.	Not always clear. Some doubt about meaning. Not always numbered. Some extraneous material included.	Clear; no doubt about meaning. In separate, numbered paragraphs. Go to the point. No extraneous material included.
6. Use of English	Long sentences with dependent phrases. Long paragraphs. Words of many syllables and beyond the experience of the pupil. Poor English.	Some sentences too long and involved. Paragraphs sometimes long. A few words beyond comprehension of pupils. Some English errors.	Short sentences. Short paragraphs. Words simple and within comprehension of pupils. Good English.
7. Use of illustrations	None or few which are not applicable and not clear and distinct.	Some; not always applicable. Not entirely clear and distinct.	Many. Illustrate steps as well as complete unit clearly and distinctly.

8. Number of pages	Three or more pages.	Two pages.	One page.
9. Size of unit	Very large. Student must focus attention on many things. Capable of being subdivided.	Fairly large, student's attention directed to three or four things.	Small; student's attention directed to only one thing.
10. Suited to pupil's abilities	Directions take in no consideration of previous accomplishment. Too elementary for advanced pupils.	Directions vary slightly to suit different levels of accomplishment. Not enough variation shown.	Directions suited for beginner or for different levels of accomplishment.
11. Feeling created in pupil	Dissatisfaction. Nothing accomplished.	Indifferent. Slight feeling of satisfaction.	Satisfaction. Knows what has been accomplished. Has desire for more.
12. Range of application	Instructions good only for the job in hand. No application outside of job.	Instructions apply to a few other jobs. Some general application of principles.	Instructions specific for job, yet general in character. Widest possible application to other jobs.
13. Questions	Questions aimless. Answered in sheet. Not pertinent to unit. Wordy and not clear. May be answered in several ways.	Questions not always pertinent to unit. Answers to some found in sheet. Not always clearly stated.	Questions have definite aim. Answer not found in sheet. Ask only for information that student can get. Clear and concise.
14. References	Numerous. Indefinite as to source. No new information contained in them.	More than two. Specific as to chapter, but not page. Give some new, some review information.	Few (one or two). Specific as to page and paragraph. Easily obtained. Give additional information.

The Importance of Equipment

Edmund J. W. Herd

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In this article the writer calls attention to the factor played by insufficient, ill-conditioned, and poorly placed equipment in the maintenance of discipline in the school shop.

THE importance of the equipment as a factor conditioning the teaching process in industrial-arts work is a matter not given due weight by many people in this field of education. It is only too evident to experienced teachers that the behavior of the student while he is in the shop may be greatly influenced by the equipment. His future attitude toward the work, whether favorable or unfavorable, may be affected by the tools with which he must perform. Indeed the very success of the teacher himself may often hinge upon this same factor, for if the equipment be poor, the teacher is handicapped from the start. There are three clearly defined aspects of this problem under which it may readily be discussed: insufficient equipment, poorly conditioned equipment, and poorly placed equipment.

If a student is interested in a project which is within the range of his ability, and the means for making it are at hand, he rarely gives the teacher any trouble. Such a student secures the tools which are necessary to do the job and keeps himself busy for he knows how the work is to be done and has the means with which to do it. But let there be an insufficient supply of these tools and there may be a variety of results. If the boy is of the unusual type, he may look about to see if there isn't something else he can do while waiting for the particular tool which he needs. The experienced teacher, however, knows that the average boy does not do this. In all probability the student will look for the fellow who has possession of the tool. Then when he locates him, he may try to borrow the tool, or he may wait until the possessor is through with it. The sly boy will try to slip it unseen from the bench of the other fellow. The bully will use the tactics of his kind to gain possession of the tool. If a boy contents himself with just waiting for the tool, he will probably get into some mischief before he has waited very long. In any event, an inadequate supply of tools frequently leads to disorder, thereby compelling the teacher for the time to become a disciplinarian.

If the teacher is thus handicapped with an insufficient number of tools, and has unwisely permitted a number of boys to make the same project, this situation will be multiplied many times and may even lead to serious disorder. In a large system where the projects are prescribed for the boys in a given grade, the teacher has no choice but to make the best of a bad situation. However, the teacher in such a situation should try each year to add those tools of which there is a shortage. A teacher who has a new shop to equip should consider well the nature of the projects which he will be called upon to have his students make, and order his equipment accordingly. There are available now many good tool lists based upon experience, which meet this need.

No less important than adequate equipment is the need for equipment which is serviceable. The tool, whether it be hand or power, which is absolutely "boyproof" has not yet been in-

vented, and yet there are some tools which are infinitely superior to others in this respect. Again, there are several concerns of national repute who cater to the schools, and in purchasing tools from such concerns one cannot go wrong. Inferior tools in school shops will not stand up. Someone has very wisely said, "Even a good mechanic cannot make a good job with poor tools." If this is true, then the boy without skill, will surely meet nothing but failure and discouragement. No amount of skillful teaching can overcome this defect. If the tools will not do their part, the boy simply cannot do his. As a result, an unfavorable attitude and a distaste for the work are soon engendered. One remedy for this trouble is to have a standard order list, which contains only such articles of equipment that have proved their worth. Then, when ordering, specify only articles which appear on this list. As a further check, there should be a place on the inventory of the shop equipment where the teacher can indicate just how different tools are standing the acid test of actual use. This would determine which tools should stay on the standard order list and which should be struck from it.

A companion to the equipment which will not stand up is the equipment which is not kept in working order. For this there is usually no one responsible but the teacher. The effect on the boy of poorly conditioned tools is the same as inferior tools and may result in other evils as well. The boy who gets his first impressions of the industrial arts in a shop where the tools are so dull they will not cut, where the handles are loose or missing, and where a myriad of containers, partly filled with different materials and not fit for use, deck the staining bench, is likely to develop into an inferior worker, with careless and slipshod work habits. Habits of orderliness, and pride in good tools, probably come more through example than by precept. From the conditions which the teacher sets up for the student's work, come the standards by which the latter forms his ideals. The teacher who neglects to keep his equipment in working order also is likely to be lax in the care of the projects on which the boys are working. Lost projects are always a source of discontent and trouble.

Many young teachers seem to feel that it is not their work to keep the equipment in order, but that someone should be engaged for this special purpose. This may be all very well if the community will stand for the expense, but tools must be kept in working order, and the teacher should not hesitate to recondition the tools should the need arise. Perhaps the student in the shop learns quite as much by example as by precept, and so it is a good thing for him to see his teacher industriously engaged in keeping the equipment fit.

The third great source of trouble is insufficient room and improperly placed equipment. Put a group of normal boys in close proximity to one another, even with supervision and something definite to do, and it won't be long before there is trouble. This is what happens in many school shops where the floor space is inadequate.

In modern industrial plants, the floor plans are laid out showing the exact location of the equipment before any attempt is made to place it. In doing this, the flow of the materials, size of passages, accessibility to equipment, and space for the operator are all given due consideration. Most school shops are not designed this way. Too often equipment is purchased without regard to the size of the room and then placed at random, with the result that students are often crowded in one section of the shop, while there may be plenty of room in another. Frequently the hand tools are placed so that the student cannot see them, hence he frequently attempts to do his work with a substitute tool which is not so well suited for the purpose. There are some instructors who feel that their students cannot learn to use certain tools, so they keep these particular ones under lock and key to be used only when the teacher needs them personally. In this way, the students are robbed of some of the enriching values of the industrial arts.

Equipment which is so placed that it makes for crowding is a breeder of trouble and causes the problem of discipline to be continually in evidence. The remedy, if the equipment is already in place, is for the teacher to make a scale layout of his shop, and study how best to locate the equipment. The changes in the shop can then be made and troubles of a disciplinary nature eliminated.

The New Industrial-Arts Metal—I

Douglas B. Hobbs

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This, the first of three articles on aluminum, deals primarily with its discovery and history. Once used principally for cooking utensils, it is utilized today in the manufacture of excavators, trucks, bridges, airplanes, stream-lined trains, and many other industrial and commercial products.

THE story of aluminum is closely connected with that of Charles Martin Hall, a young college graduate who, by his energy and resourcefulness, created a great industry.

Fig. 1. Charles Martin Hall

Fig. 2. Henri Sainte-Claire Deville

He was the son of a Congregational minister and was born in a small Ohio town on December 6, 1863. As a youth, chemistry intrigued him, and during his boyhood days, he spent many hours paging through a chemistry book his father had used in college. The book was published in 1841 and had this to say about aluminum: "The metal may be obtained by heating chloride of aluminum with potassium in a covered platinum or porcelain crucible and dissolving out the salt with water. As thus prepared, it is a gray powder similar to platinum, but when rubbed in a mortar exhibits distinctly metallic lustre."

Hans Christian Oersted, an eminent Danish physicist and chemist, had discovered the metal only sixteen years prior to the publication of that book. To obtain aluminum, Oersted

had mixed aluminum chloride with potassium amalgam and applied heat to the mixture. But so elusive was Oersted's aluminum that when the great German scientist, Frederick Woehler, repeated the Dane's experiment in 1827, he failed to obtain the metal. Later, using metallic potassium in place of the amalgam, Woehler "rediscovered" aluminum, and it was his method that Hall read about in his father's chemistry book.

At high school, Hall heard of the work of the French chemist, H. Sainte-Claire Deville, and how Napoleon III had become interested in the metal. Woehler had shown that aluminum was light and malleable. Napoleon saw in it tremendous possibilities, for if he could lighten the weight of his army's equipment, it would greatly increase the scope of its operations. Accordingly, he called upon Deville and financed his experiments to obtain aluminum cheaply and in large enough quantities to outfit France's standing army without increasing her national debt.

Deville improved upon Woehler's method by substituting metallic sodium for metallic potassium. Bars of his metal were exhibited at the Paris Exposition in 1855 and commercial production was begun at Glaciere, a suburb of Paris, in 1856. The price of aluminum was dropping. In 1852 it had been quoted at $545 a pound. Four years later, it sold for $34 a pound, and in 1859, for $17 a pound. That year, the world's production of the metal was exactly two tons!

While Deville was unable to produce aluminum cheaply enough for Napoleon to aluminize his army, nevertheless his work made possible the first commercial applications for the metal. These, of course, were of royalty, for royalty alone could afford aluminum.

At one of Napoleon's banquet tables, where sat those who were of the most importance at the moment, there were forks and spoons of aluminum. They were as bright as the silver and gold ones with which the less honored guests ate, but had a characteristic sheen of their own. Their appearance was much admired and dukes and princes marveled at their lightness. At least half a dozen were needed to balance the heavier ones of gold and silver.

The forks and spoons were made in Paris from very impure aluminum that Deville had produced in 1855. A baby rattle was designed for the prince imperial and ordered by the minister of state. The king of Siam was presented with an aluminum watch charm.

Hall knew of Deville, Woehler, and Oersted. He also knew that Sir Humphrey Davy had unsuccessfully tried to produce aluminum in 1807. By the time Hall was ready for college, he had seen the metal throw off its aristocratic cloak and become a semiprecious metal. Every clay bank was a potential source of aluminum; the metal was the most abundant of all the metals in the earth's crust, but aluminum was far from a common commercial metal.

The scene now shifts to a chemistry class in Oberlin College early in the spring of 1883. Professor Frank F. Jewett is telling the sophomore class in chemistry about aluminum and, at the conclusion of his lecture, mentions the fact that "the man who discovers a process by which aluminum can be made on a commercial scale, not only will be a benefactor to the world, but also will be able to lay up for himself a great fortune." Hall, deeply interested in chemistry, is so inspired by the remarks of his college professor, that he pokes a classmate in the ribs and confidently says, "I am going after that metal."

He meant it, too, for, undismayed by the knowledge that the foremost scientists of Europe had failed in their attempts to produce aluminum economically, the 19-year-old student began experimenting in his father's woodshed with apparatus purchased out of his meager allowance or borrowed from Oberlin College.

Deville's process, which was still in use, and others which had preceded Deville's were purely chemical in nature. Sodium was expensive and so was aluminum chloride. Should a way be found to reduce the cost of either, aluminum could be obtained more economically. One school of scientists was trying to find such a way. Another decided to turn to electricity as the most efficient means of extracting aluminum from the many compounds in which it is found in nature.

After first experimenting with various chemical methods, Hall turned to the electrolytic. There were numerous obstacles in his way. Electric power was none too plentiful and his batteries were small. His equipment was crude and his crucibles were of variable composition. Of even more importance was the fact that to electrolyze an aluminum salt, a solvent for it had to be found. He tried any number, but failure stared him in the face. A less determined youth would have given up in despair, but not Hall. He was "going after that metal," and things worth while, he reasoned, do not happen in a day or even a year.

His will to succeed finally resulted in success, and in February, 1886, he found that cryolite, a sodium-aluminum-fluoride mineral, when molten, would dissolve aluminum oxide or alumina. The cryolite could be melted quite easily at 1000 degrees C. and would hold a considerable amount of alumina in solution. With this accomplished, he tried to electrolyze the solution, but failed to obtain any aluminum. He tried again, this time using a carbon crucible. It worked! The aluminum

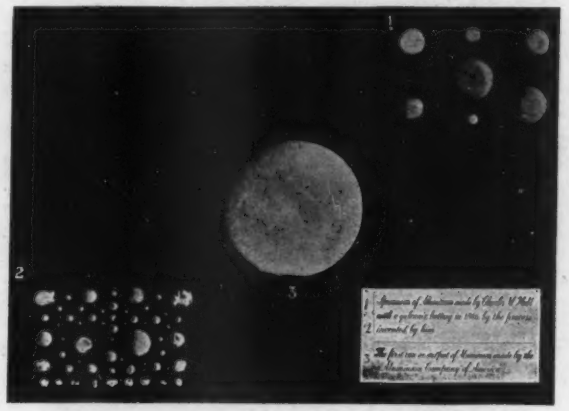


Fig. 3. The Crown Jewels of the aluminum industry. The nuggets at the top and bottom were made by Charles Martin Hall with a galvanic battery in 1886 by the process invented by him; the one in the center is the first commercial aluminum made by the Pittsburgh Reduction Company

oxide had been broken down into its component parts of aluminum and oxygen by means of the electric current. It was on February 23, 1886, that he succeeded in making aluminum by this new process. On finding the metal in the bottom of the crucible, his first thoughts were of Jewett, and holding the scarcely cooled globules in his hand, he ran to him, excitedly shouting as he showed him the metal, "Professor, I've got it!"

About the same time, a young Frenchman, P. L. T. Heroult, of the same age as Hall, made substantially the same discovery in France. Both Hall and Heroult had worked independently of each other. Neither knew of the other's experiments until after their discoveries were announced, and the process for the electrolytic reduction of aluminum, today, is sometimes referred to as the Hall-Heroult process.

The mere discovery of a method of producing aluminum did not, however, mean success for Hall. The process had to be sold. Hall had overcome scientific obstacles, one after another, but the obstacles he now encountered were of a new kind. Surely, he thought, he would have no trouble in finding a company or a group of capitalists who would be interested in his discovery, but it was not until the fall of 1888 that he was able to interest a group of Pittsburghers, headed by Capt. Alfred E. Hunt. As a result, the Pittsburgh Reduction Company

Fig. 4. The interior of the first aluminum works to employ the Hall-Heroult process

(since 1907, Aluminum Company of America) was formed to exploit Hall's discovery, and operations were started on Thanksgiving Day, 1888, in a small plant on Smallman Street, Pittsburgh, with Hall in charge of all phases of the technical activities.

The daily production amounted to approximately 50 pounds of aluminum and, although operations were on a small scale, the cost of production was less than half that of the best competitive processes. Hall visioned many things for aluminum and directed his entire energy toward finding ways and means of accomplishing them. At $5 a pound, the Hall-process metal could undersell all other aluminum, but who wanted the metal? The price was reduced to $4 and again to $2 a pound in order to stimulate the sale of the metal. There were, however, few users of aluminum. It was a newcomer among commercial metals and price reduction alone could not create a market for it.

The metal-working industry had troubles enough with the everyday metals of commerce and did not want to court disaster by trying a new one. This meant that processes had to be devised for rolling, casting, and working aluminum. Besides this, alloys had to be developed and scientific data accumulated. Fabricating processes, too, were fraught with difficulties, and defects whose causes were obscure and hard to trace, produced large losses. It was a gigantic task which confronted the infant industry, but Hall, even in his early twenties, was a veteran in determination who had the ability to overcome almost insurmountable obstacles. He knew that markets could be created only when progress had been made along strictly scientific lines.

For aluminum, and for the aluminum industry as a whole, the competition the metal encountered and the fact that the industry had to look to research and development, have proved most beneficial. The industry itself was founded on research, and it has constantly had to look to research and development to create and make new uses for its products.

How well Hall succeeded in establishing this basic principle is shown by the fact that aluminum today ranks fifth in point of tonnage among all commercial metals and is surpassed only by iron (and steel), copper, lead and zinc, metals which are literally as old as the hills.

Hall died in 1914, just as the aluminum era was beginning to dawn, yet the aluminum industry will always remain a monument to his untiring devotion to science. Men of his type are an inspiration and we can profit by the examples they set. They illustrate the fact that great inventions and discoveries are invariably the result of determination and will to succeed.

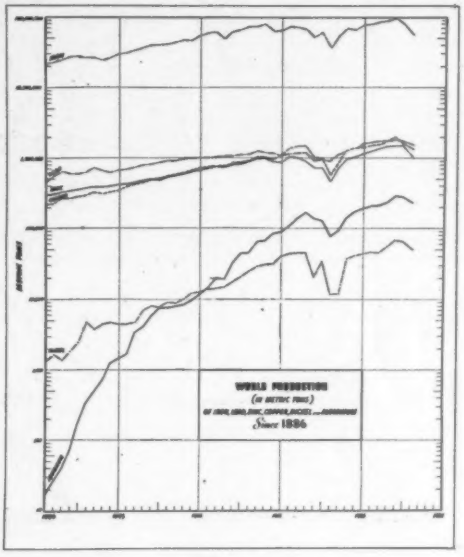


Fig. 5. The world's production of iron, copper, lead, zinc, aluminum and nickel since 1886

Questions for Discussion

1. When was aluminum first isolated, and by whom?
2. What scientist was the first to determine some of the physical characteristics of aluminum?
3. Describe the interest of Napoleon III in aluminum.
4. What was the price of aluminum in 1852? Look in your daily newspaper for the current price of the metal.
5. What was Deville's process for making aluminum?
6. How did Charles Martin Hall revolutionize the entire aluminum industry?
7. Discuss the development of the electrolytic process by Charles Martin Hall.
8. Why is the electrolytic process sometimes referred to as the Hall-Heroult process?
9. When was aluminum first produced by the Hall process?
10. Where does aluminum rank among metals today in point of tonnage?

Making Heirlooms for Tomorrow

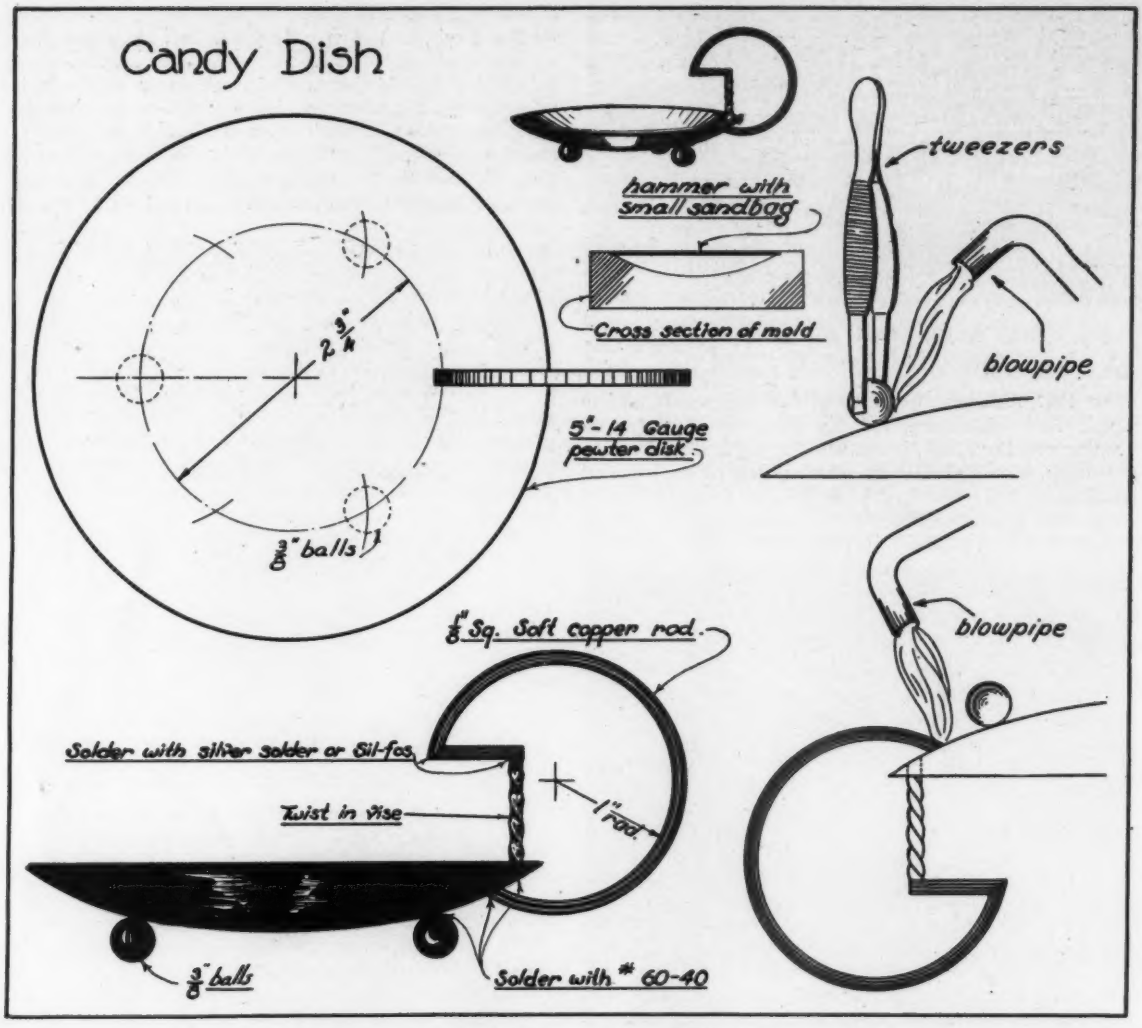
Emerson Wm. Manzer

Bronxville, New York

Setting a worth-while goal for the student who takes up pewter and art metal work.

A VISIT to the Museum of Fine Arts in Boston, the Metropolitan Museum in New York City, or to the museums of other large cities, will reveal some interesting craftwork done by master craftsmen of our Colonial periods. The historic pieces of silver and pewter form a part of the generous heritage left to this, and future generations, by those who toiled in their small workshops or in a corner of their quaint but charming homes. These treasures are the heirlooms of yesterday. We preserve them with loving care and admiration, because they embody the true spirit of those early days when craftsmanship was so intimately connected with the processes of an early life; a life fraught with hardships that were surmounted by persistent effort, sacrifice, and frequently much suffering.

The early Colonial period from 1600 to 1700 had its part in the shaping of an early handcraft civilization. The great hearth, with its glowing embers from huge logs felled by hand,



was the meeting place of the family. Here the spinning wheel, the cobbler's bench, the hand looms, and the general work-bench for wood or metal, assisted in turning out the needs of the home. This type of craftsmanship formed an integral part of the mold in which the seventeenth-century homelife was cast. Perhaps this independence, developed in the home, was a seed that later was to propagate greater independence and a fuller freedom in the next century.

The Colonial period of 1700 to 1776 brought with it the results of the frugality of the early colonists and their home-crafts. An expression of prosperity was shown in new modes of living; homes were designed in new types of architecture and craftwork was being done in small shops, rather than in the homes. This change brought with it a higher social order and finer manners gradually replaced the rough habits of pioneer days. People were at last given an opportunity to retain the manners and customs they were accustomed to in England.

Better home standards brought a demand for articles of better quality than those that were made in the home shops. Paul Revere and many contemporary craftsmen were kept busy making beautiful articles in silver. Those who had obtained wealth were glad to invest in silver as a precaution. Banks were not very safe in those frontier days.

Pewterware was still in use in the more modest homes and fortunately much of it has come down to us through private collections and the foresight of those who were interested in keeping a record for our generation.

Today, with the ever-growing interest in handcrafts, there again comes the opportunity for the modern craftsman, either professional or amateur, to produce heirlooms for tomorrow. The present modern trend has much to offer in the form of a challenge to craftsmen. We are at a turning point in the social order of the twentieth century in America. Architecture has again taken the lead and has created a demand for craftwork that will fit into the architectural mold of today.

True, not all will reach the point where their work will become treasured articles for museums, but they can produce things that will become heirlooms of tomorrow. Every article that is made by hand reflects the personality and spirit of the craftsman. It is this intangible thing that evaluates all work done by hand, and gives it a personal value to its owner.

To produce metal-craft work that will have lasting quality, one must try to develop the true spirit of the craftsman. That is, he must not be satisfied with the general run of things that are made in mass. His study of the demands of the age, the trends of architecture, the new inventions, and his study of museum pieces for modern adaptation, will tend to direct his thoughts and action. If he be classed as an amateur, he must not be wholly satisfied with the general suggestions that are offered him through various sources; he must be able to distinguish the good from the bad; he must incorporate his own ideas in the projects he makes; he must strive to create his own articles, for herein lies the greatest joy of making things.

A love of things that are beautiful must be cultivated by making visits to museums, exhibits of modern art, reading books and articles written by recognized leaders in their re-

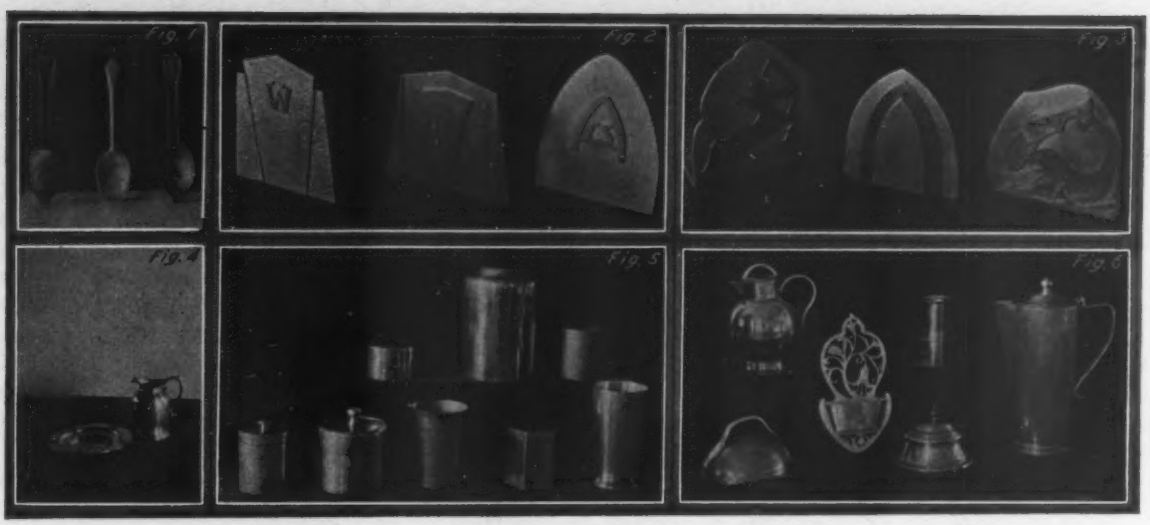


Fig. 1. Bronze spoon mold used for casting spoons about 1710 by early colonists. Fig. 2. Book ends, overlay designs. Fig. 3. Book ends, copper and pewter. Fig. 4. Plate and pitcher made by Louis S. Taylor, State Teachers College, Santa Barbara, Calif. Fig. 5. Cylindrical jobs. Fig. 6. More pretentious work. Fig. 7. The work shown in Figures 2, 3, 5, and 6 was made in the author's classes

spective fields. Good books, good friends, and good tools, form a trio that will enrich the experience gained in the shop. The formation of craft clubs has done much to foster the work of the modern homecraftsman. Hobnobbing with those who love to work with tools and materials for the pure pleasure they derive from their efforts, develops a craft spirit that will bring pleasure of lasting quality.

The modern trend of today has brought into use many new materials, methods, thoughts, and objectives. Creativeness, but with emphasis on utility, beauty, and style, is the keynote of modern projects. The candy dish suggested in this article has been designed with these above ideas in mind. It has utility, beauty, and style. To make the dish, the following procedure is offered.

Forming Mold: Cut a piece of 1¾ by 6 by 6-in. birch or maple. Draw a circle on one face and cut round. Fasten to a faceplate and turn to the shape shown in the drawing. The pewter disk, when placed in the form, should have a rim of wood around its edge to keep it centered while it is being worked. Sand the form well to remove all rough surfaces.

The Pewter Disk: Several treatments may be given the disk before it is formed in the wood mold. The surface may be planished with a planishing hammer, or peened with the ball end of a chasing hammer. The ball on the hammer must be free from all defects if a good surface is to be expected on the pewter. Any small mark on the hammer will be transferred to the pewter upon which it is used. Do not make the peen marks heavy, as this will destroy some of the beauty of the finished article.

Forming the Disk: After the disk has received its preliminary treatment, it may be formed in the mold. If a small sandbag is used to set the metal into the mold, there will be no hammer marks made on the surface of the metal. Fine sand placed in a strong canvas bag will suffice for this operation. If a hammer is used, it should be a composition hammer or a wooden hammer with a rounded end.

The Handle: Try designing an original handle if possible. If this cannot be done turn up a mandrel 2 in. in diameter. Find the circumference and cut a piece of ⅛-in. square soft copper wire equal to this length. Bend it around the 2-in. mandrel. Cut to fit suggested handle design or original. Cut piece for the upright part of the handle and twist in a vise, holding one end with a pair of pliers or inserting it in a hand drill. This part will have to be long so that the parts that were held in the vise and in the pliers or hand drill may be cut off. File joints clean and solder with silver solder or sil-fos, using borax as a flux. Clean off soldered joints with file and emery cloth. Buff at about 1750 r.p.m. on a loose buff, with the handle held on a flat surface, such as an old buff or a piece of board.

Spotting the Feet: The copper balls used on the suggested model are easily soldered in place. Find the center of the disk, draw a circle 2¾ in. in diameter and step off the diameter around the circular line drawn. This will divide the circle into 3 equal parts. Clean the surface of the balls with emery cloth. Drill a hole in a block of wood, insert the ball in the hole, which should be smaller than the ball, blow a flame from a mouth blowpipe on the ball, and touch the ball with a finger of 65/35 soft solder. Use noncorrosive flux or pewter flux. Do not put too much solder on the ball.

Soldering Balls to the Bowl: Place the ball on the selected spot. Hold ball with tweezers and blow a flame on the ball and on the disk around the ball. Do not blow hard as this will cause a hot flame and will melt the pewter disk. Use a medium flame and go slowly.

Soldering Handle to Bowl: Place a little 65/35 solder on the ends of the handle that are to be soldered to the bowl. Set the handle in place holding it there with spring clothespins or by some original setup. Blow the flame as shown in the drawing, taking great care that the flame does not concentrate in one spot. Keep the flame moving around a larger area. When the flux seems to boil, the solder is about to melt. Do not keep the flame on the metal after the solder has flushed. If necessary, return the flame to the metal to melt any solder. Several practice trials will probably save the day.

Cleaning the Candy Dish: The pewter bowl should have been buffed before the soldering. Use water to remove all excess flux. For a bright finish, buff the metal with a rouge buff and polish with a good metal polish. For a satin finish, use No. 3/0 steel wool and fine pumice stone and water. Some commercial kitchen cleansers will do the work of the fine pumice stone.

Identification: Every craftsman should have a metal stamp with his name, initials, or a stamp with a design. If the homecrafter does not have such a stamp, he should put the date and his initials on each job with a scriber. The value of articles in years to come will be enhanced by the name of the maker and the date. Thus are produced the heirlooms of tomorrow.

INDUSTRIAL ARTS and VOCATIONAL EDUCATION

J. J. Metz, Editor

Offering a Choice

With the ever-increasing need of taking care of all types of students for longer and longer periods in our school system, it is necessary to outline courses which fit not only the average student but also the exceptionally gifted as well as the slow, the lazy, and the mentally incompetent.

Much time will elapse before there are enough special-help classes devised to take care of the mentally incompetent. Until that does happen, the present school subjects must be planned that they have something to offer to all of the types enumerated. Shop teachers in many instances have already outlined their work in such a manner that they can take care of individual differences, but too many are still trying to teach their subject by assigning the same project or lesson to every boy in their classes. Of course, this method simplifies matters. Nevertheless, if the subject matter is to be equally enticing to all members of a given class, it is easy to see that a great deal of flexibility in the course must be possible. No course of study should be so rigid that it will not permit a student to do something which thoroughly interests him if he can educationally profit by it.

Of course, it is not an easy task for the teacher to arrange such a flexible course, but many teachers have succeeded in doing it. Instead of having but one project to offer for teaching certain definite operations a number of projects embodying the points to be emphasized are offered so that the students have the opportunity of making a choice. This method, while not new, is not sufficiently used. It has worked well for those shop instructors who have had the foresight and the courage to adopt it, and it deserves a more widespread application in the work offered by industrial arts and vocational teachers.

Accommodating Them All

Again and again one hears an irate shop teacher complain that "all the dumb-bells in the school are sent to my classes." While this deflection of subnormals to the shop may be deplorable, because it seems to be based on the premise that it takes but mediocre intelligence to learn how to do a presentable job with tools manipulated by the hands, yet it also presents a very worth-while challenge to the shop teacher.

The pupils with the low I.Q.'s, whether wanted or not wanted, are in the school. They are confronted with the same problem that faces their more fortunate brethren — that of learning how to live and how to earn a living. The fact that they do not readily grasp the meaning of the abstract studies which adults have set down as a proper training for life, does not exclude them from the human family. They have the same claim upon the world and upon the school as have the normal and the superior children.

When the authors of the Declaration of Independence wrote: "We hold these truths to be self-evident: That all men are created equal; that they are endowed by their Creator with certain inalienable rights; that among these are life, liberty, and the pursuit of happiness," they did not mean to convey the idea that all men are equal in their capacities and capabilities. They did recognize the fact, however, that all human beings crave and blindly grope for happiness, and that all of them should have an equal opportunity to make the best of that with which they were endowed by their Creator.

Since so large a percentage of the students now in school will eventually be absorbed by industry, it is well for the teachers of industrial arts and vocational education to take a broader view of the task which confronts them. These low I.Q. students have a right to get every opportunity for developing that which is within them and since industry offers such a wide divergency of needs, requiring as it does workers of every type from those who need little or no skill to those who must possess the very highest and finest type of mental and manual dexterity, the shop teacher ought to welcome the opportunity of helping to prepare these handicapped youngsters, who in a few short years will be members of that vast army of workers that, in one way or another, will help to produce the many wonderful things for which this country is noted.

To do this job well will require thoughtful planning on the part of every shop teacher. It will mean the making of broader analyses of how industrial arts and vocational education is to function in the life of every school boy, whether of high or of low intelligence. The adoption of this broader viewpoint by the teacher of shopwork does not mean that he accepts the common notion that, if a boy cannot make the grade in his academic studies, he thereby shows a peculiar fitness for shopwork. Studies have been made to show how erroneous this idea of school administrators is. It does mean, however, that the shop teacher recognizes the necessity for broadening the scope of his work, that he is trying to make it applicable to a wider range of abilities, that he definitely recognizes human limitations, and that he is working toward their best utilization. Just as the physically handicapped want, not charity but a chance, so these mentally handicapped also are entitled to their opportunity.

Industrial-arts teachers taking this view of their work will do much in making their work more attractive to their students, more effectual in the curriculum, more meaningful to the community in which their work is offered, and more effective in equipping their students with the things that are to function in their later life.

Common Woodworking Tools—IX

E. M. Wyatt
South High School, Cleveland, Ohio

The ninth and last installment of the history of woodworking tools.

SOME MISCELLANEOUS TOOLS

THERE are several woodworking tools whose histories are too brief to make up a special group, yet, for the sake of completeness, should not be omitted. We can conveniently group these together for the final chapter of this series.

The Knife

Man's first knife was probably the sharp edge of a broken stone. When he learned to break stones to definite shapes, he usually shaped them to a roughly circular or elliptical shape like Figure 11 in the history of the ax. In many places throughout the world, where primitive men have lived, can be found these crude cutting implements which archaeologists call celts. The Dawn Man probably used them for many purposes — cutting up his food, skinning animals, scraping hides, digging roots, opening molusks, shaping wood, and, in fact, for all cutting and scraping purposes. When he learned to flake stone to more intricate shapes, he formed more specialized tools. The flaked knife of Figure 96 and the ground one of Figure 97 were less valuable as digging and scraping tools but, having places especially planned for the hand, were more usable for their intended purpose as strictly cutting implements. If we accept these crudely formed stones as knives, the knife is probably the oldest tool of man surviving to the present day.

During the Polished-Stone Age, men made what are now called stone chisels. These, however, were probably seldom if ever used as we think of chisels being used today; they were more likely used as skinning knives and held as shown in Figure 98. Occasionally, more conventionally shaped stone knives were made by the Stone-Age Man as, for example, the handled Eskimo knife shown in Figure 99. The stone knife seemed to survive into the Copper, Bronze, and even the Iron Ages for ceremonial and religious purposes. There is evidence in the Bible[1] that the Jews during the Bronze Age used a stone knife for circumcision, and we know that the Egyptian embalmers used stone knives in their work long after metal implements were used for other purposes.

Fig. 96. Flaked-Stone knife. The handle end was probably wrapped with fiber or skin to protect the hand. Fig. 97. Polished-Stone-Age skinning knife. Fig. 98. Stone chisel used as a knife. Fig. 99. Eskimo knife with ground-slate blade and bone handle

When man learned to beat native copper into tools, he made knives from it. With the new material, he frequently deviated from the established stone forms as evidenced by the Peruvian knife shown in Figure 100. This form of knife is not peculiar to Peru, however, as the Alaskan Eskimos still use quite similar "squaw knives" made of slate or, where they can get it, of metal. See Figure 101.

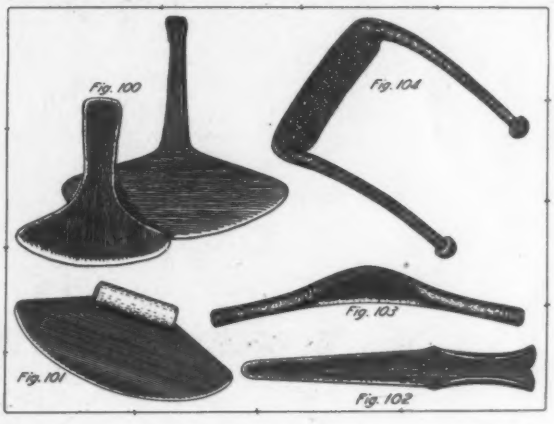


Fig. 100. Ancient copper knife from Peru. These knives very much resemble the squaw knives now in use among the Alaskan Eskimos. Fig. 101. Eskimo squaw knife made from a piece of old saw blade. Fig. 102. Bronze knife from the Bronze Age in Italy. Fig. 103. Iron drawknife from Pompeii, 50 B.C. Fig. 104. Iron drawknife from Avergne, of the later Roman period

During the Bronze Age, the knife became more the long-bladed tool we think of as characteristic of that tool. It varied considerably in form, as it does now, depending on the purpose it was intended to serve and, probably, according to the artistic or utilitarian ideas of the maker. These bronze tools were formed by casting with the blades somewhat forged to harden and sharpen the cutting edges. The handles were frequently cast as a unit with the blade as on the bronze knife shown in Figure 102.

When men learned to work iron, the knife became a forged tool and it became less practical to make the handle as a part of the blade. The knife became less and less an all-purpose cutting tool and was shaped to suit a special use.

The clasp or spring pocketknife apparently originated in Flanders. Anyway, the first ones to appear in England were imported from there in the early part of the seventeenth century.

The woodworker's special knife, the drawknife, dates back to the time of the ancient Romans. It was probably made first without wooden handles, as was the one found in Pompeii, shown in Figure 103, but the Romans must have made them with wooden handles, for the one shown in Figure 104 is believed to date back to the later days of the Roman Empire. It is very little different from the drawknife of today.

[1] Exodus iv. 25.

There is little significance in the changes in the *form* of the knife. It is, and always has been, simply a sharp cutting edge. The form of the blade has always been controlled by, first, the material from which it has been made and, second, by the material it was designed to cut. The uses for which knives have been made have varied or changed but little, hence the evolution of the knife has been mainly one of the materials from which they have been made — stone, copper, bronze, iron, and now steel.

The Mallet

Excavators in Egyptian tombs have frequently found discarded or forgotten wooden mallets of the type illustrated in Figure 105. They are the impact tools that were doubtless used in carving the stone for the pyramids, tombs, and temples

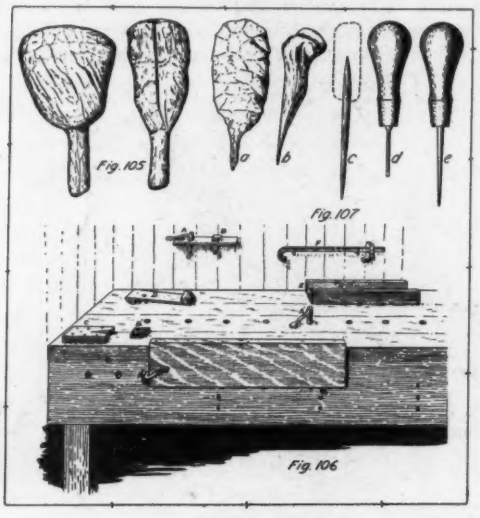


Fig. 105. Ancient Egyptian club-type mallet, the nearest thing to the hammer that they developed. Fig. 106. Ancient holding tools. A, A', A", hold fast; B, B', catch; C, bench clamp; D, side rest; E, miter box; F, cabinet clamp. Fig. 107. a, Stone-Age awl; b, primitive bone awl; d, modern brad awl; e, modern scratch awl

of this ancient civilized race for, strange to relate, the Egyptians never learned to make a hammer — not even a stone one. Probably these billetlike mallets were the forerunners of our modern two-piece form, but the writer has never been able to discover just who gave it its present form.

Holding Tools

Though the cabinetmaker's vise is an old tool — perhaps going back as far as the days of the old Romans — it was quite a luxury in days when screws had to be laboriously carved out by hand. Those that were found had large wooden screws, since the larger the screw the less relative accuracy was required in making them. They were of the type still found on some old manual-training benches.

Many workers of wood had no vise at all, and equipped their benches with other holding devices such as are shown in Figure 106. The *holdfast* — A, A', A" of the figure — was a simple blacksmith-made tool that served the workman for a great many holding purposes. Driven into an auger hole in the side of the bench, it held a board for edge planing; on top, it held work for mortising, carving, shaving, and, when used with the *catch* — B, B' — for broad-surface planing. It was made to fit loosely in auger holes conveniently located about the bench, and was tightened or loosened by a blow of a hammer or mallet. It was quite an efficient auxiliary to the bench but is used very little now, simply because the vise with which every modern woodworker's bench is equipped, makes it unnecessary.

The *catch* was a simple blacksmith-made tool that is still retained on the modern bench under new names and in improved forms. With the *holdfast,* it is pictured in Moxon's book. They are probably really ancient bench auxiliaries.

The humble *bench clamp* — C — still found nailed to most carpenter's benches, is such a simple tool that most of us would venture the opinion that it is a very ancient device. It is really quite a modern invention, for Mercer states that in 1843 the English Society of Arts rewarded a man named Nichols for inventing it.

The *side rest* — D — or bench hook, as we now call it, is evidently quite an old woodworker's tool for we have an illustration of it dating back 250 years. It was illustrated as being made from a single piece of wood, and the text regarding it mentioned it as used hung over the side of the bench to support boards for edge planing.

The wooden *miter box* — E — still used by house carpenters, when a better one is not at hand, is pictured in Moxon's *Mechaniks Exercises* just as made today.

When screws were expensive, cabinetmakers' clamps were made without screws as shown at F. The movable jaw gripped when set by the backward turn it received from the pressure on what it clamped. It was tightened or loosened by blows of a hammer and by springing the bar. Though a simple tool, it was an effective one when properly made. Probably the screw-type clamp is quite an ancient tool, but this plain one must have been the popular form in olden times, as a seventeenth-century French encyclopedia shows it among the typical tools of the cabinetmaker.

The Awl

The awl is very likely one of the oldest of man's tools. The first awls may have been thorns he broke from trees, or the slivers of wood or bone he broke up to make them. But we know that during the Stone Age, stone awls, like the one shown at Figure 107, were made. They must have been valuable implements to prompt the care, patience and skill that must have entered into the making of such a tool.

During the Copper Age, primitive man forged out of native copper many needlelike bits of metal that must have been handled and used as awls. Such a one is shown in Figure 107 at C. Many of these awl points have been found in the mound builders' mounds of the Mississippi Valley, and in fact in almost every copper producing region of the world.

During historic times, iron replaced the older copper and bronze points, and in modern days the iron has given way to steel.

The primitive awl was probably quite a general-purpose tool. The same implement served to pierce, to enlarge holes, to skewer food in cooking, to scribe and mark, and even for sewing garments. The modern awl, however, is quite a specialized tool. Many crafts use the awl and modify it to their particular needs. The woodworker has two quite distinct awls — the bradawl, shown as d, and the scratch awl at e, Figure 107.

As a woodworking tool, the awl is undoubtedly being displaced by other tools, and the next generation will likely know as little of it as this one knows of the ox goad and broadax. Probably a large proportion of the younger woodworkers who may read this could not clearly differentiate between a brad-awl and a scratch awl. The spiral and wheel drills have displaced the bradawl, and the carpenter's pencil and layout knife the scratch awl. The few awls now in use are more used to hold chalk lines than to serve the purposes for which they were originally designed. Within the span of our memory this tool, older than civilization itself, is being evicted from the place it held for aeons in the woodworker's tool kit.

Problems and Projects

A MONOPLANE — THE HARDESTY SPECIAL

(See Supplement No. 313)

Terence Vincent, U. S. Director for Miniature Aircraft Fliers, Station KFI, Los Angeles, California

The monoplane described herewith is named after its designer, Tomalee Hardesty, age 16. This airplane looks artistic, takes off and alights in a perfect manner, and flies sufficiently long to please the most fastidious.

The plans shown in Supplement No. 313 are full size. If desired, the dimensions may be doubled for the more expert student.

The monoplane has a detachable motor with easily adjusted propeller and nose plug. The tail surfaces are movable and the entire plane weighs but ⅝ oz. when completed.

Its lo-wing is firmly attached to the fuselage by means of a pair of slanting struts on each side, and by conventional cementing where the root-ribs join the body.

Here are the materials needed to make this monoplane:

Hard balsa for landing-gear struts, wing struts, braces, longerons, leading and trailing edges, and wheels.

Medium balsa for all formers, propeller, spinner, nose plug, pants, wing fillets, wing spars, wing tips, tail surface outline, tail braces, faring strips, stringers, and center wing spars.

Soft balsa for cylinder bank, headrest, and wing ribs.

Bill of Material

7 pc. 1/16 x 1/16 x 36	Fuselage, longerons, and braces, braces in tail surfaces, and wing spars
1 pc. 1/16 x 1/8 x 36	Surfaces and wing spars
6 pc. 1/32 x 1/16 x 36	Stringers on top, sides, and bottom of fuselage
1 pc. 1/32 x 2 x 36	Fuselage formers and wing ribs
1 pc. 1/16 x 2 x 36	Wing tips and tail outlines, landing-gear struts, and sides of pants
1 pc. 3/32 x 3/32 x 36	Leading edge of wing
1 pc. 3/8 x 3/8 x 12	Headrest and wing fillets
1 pc. 5/8 x 5/8 x 3	Cylinder bank
1 pc. 1 x 1 x 1½	Spinner
1 pc. 3/4 x 1 x 5½	Propeller
1 pc. 5/16 x 1 x 7	Center section of pants
2 pc. 1 x 1	Balsa or celluloid for wheels
1 pc. 1 in. sq. or less	Celluloid for windshield
1 pc. 3 in.	Reed or tube rubber for cockpit outline
1 pc. 16 in.	Steel wire for propeller shaft, rear motor hook, and wheel axles
1 pc. 1/16 in. sq. x 48 in.	Para rubber for motor
1 pc. 20 x 34	Airplane tissue paper

½ oz. silver dope
½ oz. nitrocellulose cement
½ oz. banana oil or airplane dope for attaching paper to wood, and for varnishing paper surfaces lightly
1 small soda straw for exhaust stacks
2 tiny, thin washers for propeller thrust bearings

All parts are balsawood, except where otherwise stated.

There are a number of approaches, in making the Hardesty Special monoplane. It is fairly simple to cut all the ribs first, then make the entire wing; or it is all right to make the fuselage formers first, and build the body foundation, and proceed from there to the tail, landing gear, propeller, and wing.

Suppose the propeller is made first, with the propeller shaft, thrust bearings and spinner. When the nose plug is completed, the propeller can be added, and that unit is completed, ready for the silver painting.

While the propeller unit is drying, the ribs may be cut and properly shaped as indicated, then cemented to the leading and trailing edges, and the spar. It may either be covered at once, or after the entire monoplane structure is completed.

The Hardesty Special and its designer

When the body formers are finished, and the longerons properly cemented in place, then the stringers may be cemented in place. The landing gear and tail parts may then be added, the wing placed properly on the fuselage, and the final covering done.

Before any dope-painting is done, the plane may be tried out as a glider or it may be flown. It may also be weighed, then doped, after which it is again to be weighed to get the total weight of the dope.

The final weight when completed is about ⅝ oz.

BOWSTRINGS*

W. Ben Hunt, Handicraft Instructor, Boy Scout Troop 98, Hales Corners, Wisconsin

The bowstring plays an important part in archery. It must withstand strenuous usage and as it is continually pulled and jerked violently, it must be made of material which does not stretch. Irish flax or linen has been found to answer well for this purpose. Barbour's Irish flax sinew (6-cord) is the easiest to obtain and can be bought wherever shoemakers' supplies are sold. As it is obtainable only in a large ball, which at the present time costs about two dollars, and as there are many bowstrings in a ball, it is best for several to club together to buy it. Besides this, some thin flax, such as Barbour's No. 12

*Note: In the article on "The Flat Bow" which appeared in the last issue of this magazine, the three lower sections shown in Figure 6A on page 180 should be reversed. The flat side or back in each case ought to be shown uppermost.

or some heavy silk thread or fine linen fishline, will be required for serving or wrapping. Beeswax also is one of the items needed.

How the String is Made

Start out by driving two nails the length of the bow plus 1 ft. apart. Around these wrap 6 strands of the 6-cord Barbour's flax. Then cut all the loops apart at the finishing nail, as shown in Figure 35.

Fig. 35

Since a string of this length is rather awkward to handle, it is well to keep the floor clean while making the bowstring. Sand, dirt, and grit adhering to the waxed string will not improve it.

Fig. 36

Fig. 37

Tie a loop at the closed end (see Fig. 36), and put this loop over a nail or hook that will stand quite a pull. Now wax each strand separately, after which open up the loop and cut the strands on that end unevenly, as shown in Figure 37. Next, wax the ends which have been just cut apart.

Fig. 38

Then, starting about 5½ or 6 in. from the end of the shortest strand, twist all the strands evenly (see Fig. 38) for about 2½ in. or more toward the end, and wrap or serve evenly with Barbour's No. 12 flax, or heavy silk thread. Put on this serving as tightly as possible (see Fig. 39).

Fig. 39

Form a loop of the served part, as shown in Figure 40. Holding the loop in the left hand, separate the ends into three pairs, each pair being one long and one short strand, as shown at A in Figure 40. Next separate the long strands shown at B in Figure 40 into pairs. Then lay one of the end pairs A along one of the long pairs B as shown in Figure 41 and wax

Fig. 40

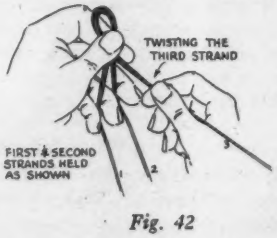


Fig. 42

Fig. 41

them together. Examine the cord and if it is twisted toward the right or left, then twist each one of these strands of 4 toward the right or left as the case may be, using plenty of wax. It is somewhat difficult to do this part of the job alone, but by holding the loop and the strands as shown in Figure 42, one can manage it after a few attempts. If a helping hand is near, it is easier for one person to hold the loop and twist, while the other holds the strands and keeps them from untwisting, or the loop may be held in the vise.

It might be well to go over this explanation once more. Hold the loop between the thumb and first finger of the left hand. The 3 pairs of short ends (one long and one short strand to a pair) are laid along the 3 pairs of long strands and stuck together by stroking, so that the result is 3 groups of 4 strands each. Twist the first set of 4 together very tightly, then swing it down and hold it between the third and fourth fingers, as shown in Figure 42. Then take the next set of 4, twist it the same amount and hold it between the second and third fingers. Now twist the third strand, always remembering to start as close to the loop as possible and twisting it past the longest of the short ends.

When all three strands are tightly and evenly twisted, place them together and twist them in the opposite direction. This forms the splice, and should look like Figure 43.

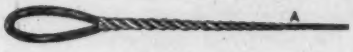


Fig. 43

Hold the strands firmly at A, Figure 43, with the left hand to prevent untwisting, and thoroughly wax the splice. This completes the splice, but to make sure that it will not open by handling, it is best to wrap or serve the entire splice, starting a little above the wrapping of the loop and continuing to beyond the longest end of the shorter pieces, as shown in

Fig. 44

Figure 44. The wrapping is secured by slipping the end under a couple of loose coils after which it is pulled up tight. Wax the whole loop, working the wax in well with the fingers.

Now place the loop on the hook again and straighten out the 6 single strands and apply wax to each strand. Then, starting at the loop, gently roll the 6 strands together, working them back and forth between the palms of the hands along the entire cord until the other end is reached (see Fig. 45).

Fig. 45

Fig. 46

See that the strands are evenly laid and then twist them in the same direction that the single strands are twisted. Do not, however, twist the entire cord too much. It should look about like the section shown in Figure 46.

Now fasten the end of the bowstring firmly to some object or have someone hold it as taut as possible, while it is thoroughly waxed all over once more.

Then take a piece of soft leather or some brown wrapping paper and rub the entire string briskly. This warms and partially melts the wax and unites the strands into a real bowstring. If colored paper is used for rubbing, a pleasing tint may be given to the cord.

Fig. 47

Finally, tie a knot at the end of the now finished bowstring to prevent the strands from untwisting. After the proper length has been determined, the end may be served for a distance of ¼ or ½ in.

The usual fastening at the lower nock is with a timber hitch, tied as shown in Figure 47.

The string just described will take a bow of any weight up to 40 lb. If a heavier string is wanted, use 9 strands of the 6-cord Barbour's Irish flax sinew instead of 6 as for the string just described. To form the loop on this heavier string, make 3 groups of 3 short and 3 long ends instead of 2 short and 2 long ends, and proceed just as with the lighter string.

For bows pulling 30 lb. or more, the loops may be reinforced by laying in an extra strand for each of the three groups and working it in with the others. These strands should be about twice as long as the distance from the ends to the middle of the loop (see Fig. 48). This reinforcing is not so essential if the loop is wrapped tightly and evenly.

Fig. 48

After the bow has been properly braced, the string should be served at the nocking place to a thickness of almost ⅛ in. and long enough to cover that portion of the string touched by the fingers while shooting. This saves the string from wear and at the same time is easier on the fingers. This serving should be done while the bow is braced. Sometimes the string is served with a contrasting color at the exact point of nocking to assist the archer when shooting.

AN ALUMINUM PICTURE FRAME

Murray V. Churchill, Pittsburgh, Pennsylvania

By taking a picture out of its frame, one can realize what an important part the frame sometimes plays. In fact, whether plain or fancy, the frame should be a work of art just as much as is the photograph which is displayed in it. The picture frame shown in Figure 1 involves not only the cutting, bending, casting, joining, and finishing of metal, but also the turning and carving of wood.

The metal used is aluminum. For the frame proper, cut a 5½ by 7¾-in. rectangle out of a 1/16-in. sheet. With a scriber or marking gauge, draw a 3½ by 5¾-in. rectangle inside of the first, with each side parallel to, and 1 in. from the edges of the larger rectangle. Somewhere inside of this inner rectangle, close to one of the longer sides but not quite against it, cut out a small rectangular hole with a stencil chisel (which is nothing more than a sharp cold chisel). This hole is for the sole purpose of admitting the saw blade. It could also be made by drilling a series of overlapping ⅛-in. holes.

Pass a hack-saw blade through the hole and clamp it in the saw frame. Saw along the line and follow it to a corner. In going the long way it will probably be necessary to clamp the blade in the reversed position in order to follow the line all the way. Release the blade, put it through the slot the opposite way, and saw to the opposite corner. Saw each side of the 4½ by 6¾-in. rectangle by the same method. While sawing, bear down on the outstroke only, to avoid dulling the blade. When the center piece is cut out, take a medium flat file and trim the edges to the line, also remove any burrs which may have been formed during sawing.

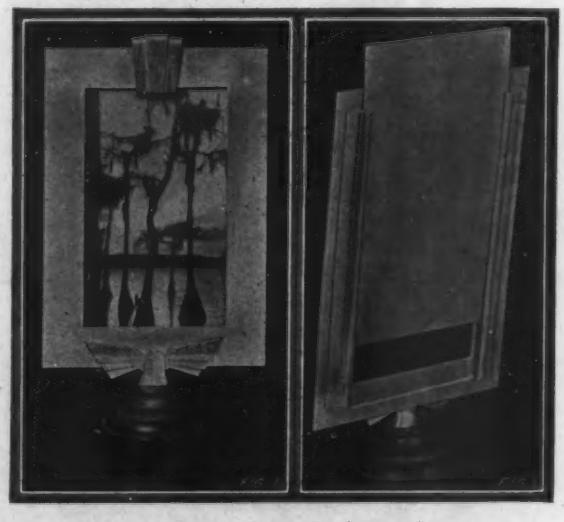


Fig. 1. Front view of picture frame
Fig. 2. Back view showing retaining strips

The back of the frame with the picture partly slid out is shown in Figure 2. The two strips which hold the glass and picture in place are made of an aluminum sheet, .025 by 1 by 7 in. These are bent along two parallel lengthwise lines so as to give a cross section shaped like an open Z. The bottom part of the Z will rest on the frame that has just been finished, while the upper one holds the picture in place. The strip is bent as follows: Clamp the strip in the vise between two sharp-edged pieces of iron plate about 8 in. long, so that ½ in. of the width is exposed. Bend this portion forward with fingers, and flatten it down with a hardwood board and a hammer. This forms the bottom flange. Now loosen up the vise and lift out the strip so that 3/16 in. more of the width is exposed. This will be the approximate depth of the web. By placing a square-edged strip of steel under the ½-in. flange, bend the strip in the opposite direction and flatten out the web just as was done with the flange. This leaves a 5/16-in. flange clamped in the vise.

This method of bending the strip may seem complicated, and the question may be asked, "Why not simply bend the strip with pliers?" The answer is that when a narrow metal strip is bent with pliers alone, warping is almost sure to occur as the outer edges become stretched while the line of bending remains unchanged in length.

Some provision must be made to keep the picture from sliding out at the bottom. Lay the strips side by side, with the wider (½-in.) flanges down and opposite to each other. On the ends which are to be toward the lower part of the picture frame, mark a line across both flanges about ¼ in. from the end. Cut in along this line as far as the web, and then cut along the line of bending so as to remove two small rectangular pieces from each flange and leave the web projecting from the bottom of the strip as a small square tab. Bend this in so that when the strips are in place, the tabs will keep the picture from sliding out at the bottom.

The next thing is to fashion the ornamental winglike bracket which supports the frame. The simplest way to make it is to cast it, but if there is no equipment available for making sand castings, the ornament may be shaped out of a small piece of ⅜-in. plate. This will not be unduly difficult if one saws it out to the rough outline and then uses an emery wheel to take the heavy surface cuts. The wings are 3⅜ in. from tip to tip. The top edges slope downward to the center at a rate of about 1 to 8; in other words, 1 in. in from either wing tip the top border of the wing is ⅛ in. below a straight line joining the wing tips. The lower corners are 2⅛ in. apart and are ⅜ in. below the line joining the upper corners. Grind the wings flat on the back and front to an approximate thickness of 1/16 in. thick. File in the steplike notches on the side edges and also file, in low relief, the stepped-back lines matching these on the front. The ornamental finishing of the surface is not done until the parts are assembled.

The upright central portion of the bracket is oval in cross-section near the bottom, but toward the top it is semioval, since the back is ground flat along with the wings. At the bottom it is ⅜ in. thick and ¾ in. wide; at the top it is 3/32 in. thick from the flat back surface to the curved front, and is 7/16 in. wide at the point where the wings join it. It should taper in a slight curve from the bottom to the top, and the tip should be rounded.

The bracket is joined to the wood base by means of a slightly tapered ⅛-in. metal dowel projecting from the bottom of the bracket. This will prove one of the most difficult parts of the project, due to the fact that the picture frame must be given a slight backward slant for appearance' sake. This means that the dowel pin must emerge at an angle to the plane of the wings. A backward slope of 1 to 8 is about right. Viewed from

the front, of course, this dowel should appear exactly vertical. When filing the pin to its final dimensions, also file off the bottom surface of the bracket so that it is perpendicular to the pin. Thus, the bracket will rest solidly against the base.

Drill two ⅛-in. holes in the wings with their centers ⅛ in. down from the top and 1¼ in. from each center line. Drill two holes in the frame proper to line up with these on a line about 7/16 in. from the bottom edge. Also drill three 1/16-in. holes (or smaller) in each side of the frame, spacing them 3 1/16 in. apart on a line midway between the outer and inner edges of the border, and drill holes to correspond with these in the ½-in. flanges of the retaining strips locating them ⅛ in. from the web. Finally drill a 3/32-in. hole in the middle of the top border of the frame and countersink it on the back.

Fasten the wing bracket to the frame by means of ⅛-in. rivets and file the heads flush with the surface on both sides. If the rivets are driven properly, they will hold without heads, for the object of riveting is not so much to mushroom the head of the rivet as to bulge or upset the shank. To do this, use the ball-peen end of the hammer, place the work on the anvil of the vise, and use a few firm, solid blows, and then know when to stop.

The side strips are fastened on with 1/16-in. rivets. In case these cannot be obtained, they can be filed easily out of soft aluminum wire. Use lighter blows on these rivets and as before, stop hammering when the rivet has been headed. Excessive driving does not further tighten a rivet in a thin sheet, but actually loosens it by spreading the rivet hole.

The wing bracket can be given an ornamental surface treatment by the use of several types of gravers. This conceals the rivets. Buff the whole metal assembly with a medium fine grade of buffing compound to give it a satiny finish.

The round base and keystonelike plate at the top of the frame can be made of any hard wood suitable for turning and carving. That shown in the picture is mahogany. The base is 2½ in. in diameter at the bottom, and is turned down on a lathe to the shape shown. When the base is turned, drill a ⅛-in. hole along its axis.

The plate is carved out of a 1¼ by 1¼ by 1¼-in. block of hard wood. On the front, mark two converging lines 1¼ in. apart at the top and 1 in. apart at the bottom. Plane away the narrow triangular parts left on the sides. Mark two more lines 5/16 in. inside of the edges, that is, 9/16 in. apart at the top and 5/16 in. apart at the bottom. With a sharp knife or a wood chisel, cut away about 1/16 in. of the surface on each side of the center and also cut back the top the same amount so as to leave the central wedge-shaped section in relief. Mortise out the back to a depth of 1/16 in. so as to fit exactly over the frame. Round off the top and bottom edges and smooth up the whole piece with file and sandpaper.

Stain the base and top plate to match. Clear varnish is all right, but a deep red or black gives a more pleasing contrast with the aluminum. Screw on the upper plate and insert the dowel of the bracket in the base. If the dowel will not enter, file it down until you can just force it in by hand.

A pane of glass should next be made to cover the picture. Measure the distance between the offsets of the back strips for the exact width. The glass should be cut just wide enough so as to slide easily between the two. The size will be approximately 3⅞ by 6¾ in. The cutting of glass is relatively simple. For small jobs such as this one, a steel-wheel glass cutter, costing about a quarter, will suit the purpose. Lay a straightedge along the line where the cut is to be made and make a firm single stroke with the glass cutter. Lubricating the cutter with kerosene may help. If enough of the edge projects on the glass, it is usually possible to snap it off with the fingers while holding the other piece down with the straightedge. If not, that is where those little notches on the back of the cutter come in. Slip the edge of the glass near the middle into the notch of the nearest size and use the cutter as a lever to break off the strip of glass.

Many photographs will not lie flat unless they are backed up. Therefore, cut a sheet of aluminum to the same size as the glass and use it as a backplate.

22-INCH MODEL KNOCKABOUT

E. A. Ferns, Northern State Teachers College, Marquette, Michigan

Step I. Gluing Pieces Together

1. Cut one piece, 2 by 5½ by 22½ in., and one piece 1 by 5½ by 16½ in.
2. One face of each piece should be surfaced.
3. Clamp the pieces together as shown in Figure 1, with 5 hand screws and have the joint inspected by the instructor. The 1-in. piece must be located as shown in Figure 1.

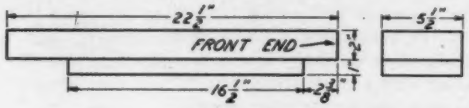


Fig. 1

4. Remove the hand screws and apply waterproof glue to the surfaces of the joint. Then clamp the pieces together again and set away to dry.

Step II. Planing Hull to Thickness

1. Plane the face of the large piece true. This will be the deck.
2. Gauge to a thickness of 2⅞ in. Glue an extra piece on the keel if necessary.
3. Plane to the gauged line.

Step III. Marking Station Points and Cutting Deck to Shape

1. Draw center line AB on the deck as shown in Figure 2.

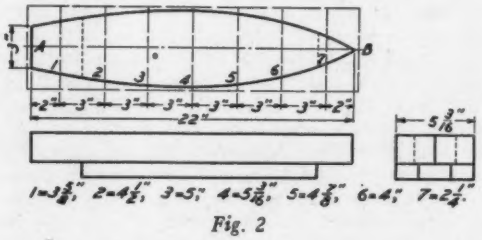


Fig. 2

2. Locate the station points 1, 2, 3, 4, 5, 6, and 7, and number them.
3. Lay off the widths at each station point, centering them carefully.
4. Draw a smooth line through the points just laid off.
5. Cut out the shape to within 1/16 in. of the line.
6. Plane edge down to the line square with the deck.

Step IV. Cutting Bottom of Hull to Shape (Keel)

1. Lay off the heights at each station point. Do this on both sides.
2. Nail block to deck as shown in Figure 3. This block is to be clamped in vise to hold hull while shaping it.

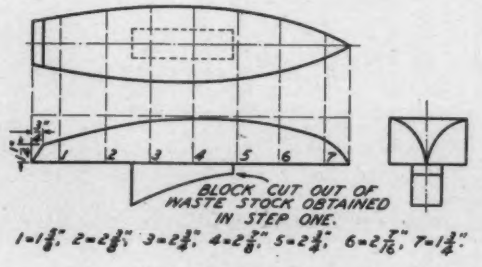


Fig. 3

3. Using plane and spokeshave, cut to lines.
4. Test with square straight across block.

Step V. Cutting Hull to Shape (Continued)

1. Draw center line of keel on the bottom of the hull. This is line AA in Figure 4.

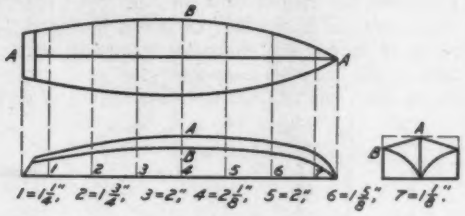


Fig. 4

2. Lay off the heights shown in Figure 4 at each station point. Do this on both sides.
3. Using plane and spokeshaves, cut to lines A and B.

Step VI. Cutting Hull to Shape (Continued)

1. Cut templates for the various stations. The full-sized profiles are as shown in Figure 5.
2. Extend the station lines down the sides of the hull and across the bottom.

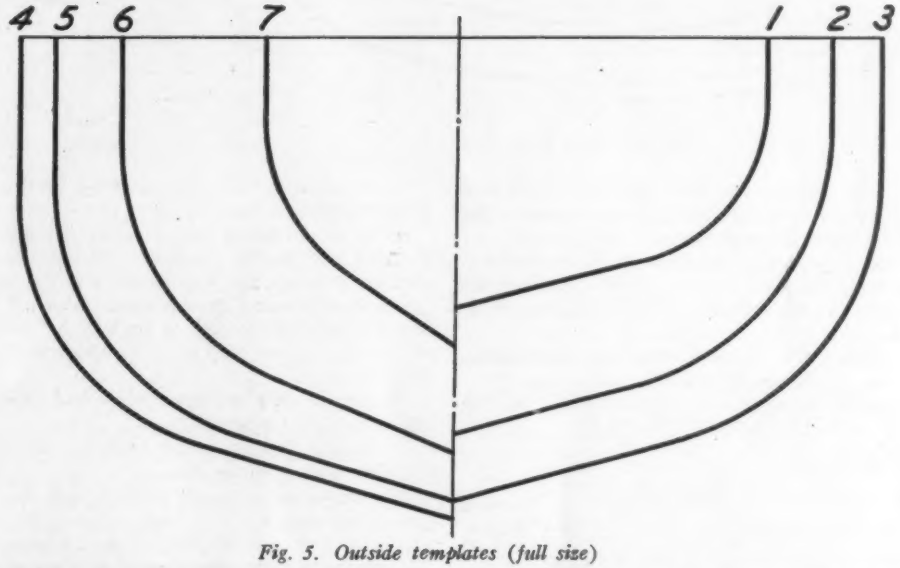


Fig. 5. Outside templates (full size)

3. Remove corners with plane, spokeshave, and rasp to fit templates. One edge of template must be even with deck and the other end on the center line of keel, as shown in the sketch.

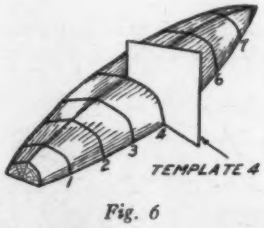


Fig. 6

4. Test with templates 1, 2, 3, 4, 5, 6, and 7 on the stations having the same numbers. Begin with No. 4, as shown in Figure 6.

Step VII. Making Cradle to Hold Hull for Gouging

1. Trace outline of deck on baseboard.
2. Toenail the waste blocks remaining from Step I along this outline as shown in Figure 7. Turn over and nail through board into blocks.
3. Place cleat on top near each end, nailing one end and

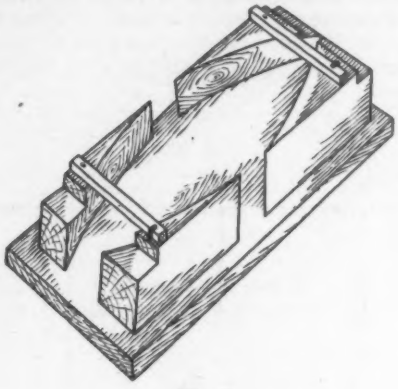


Fig. 7

holding the other end with a screw hook. This makes it possible to turn a cleat out of the way when gouging at the bow or stern.

4. Place paper in cradle to keep outside of hull from being damaged while gouging.

Step VIII. Gouging Out Hull

1. Gauge a line ¼ in. in from edge of deck as shown in Figure 8. Round off lines 1½ in. from bow.

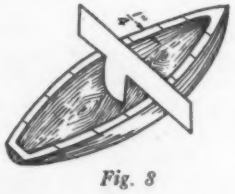


Fig. 8

2. Make a new set of templates for the inside of the hull. Figure 9 gives these full size for the various stations.
3. Part of the waste stock may be removed with a forstner bit.
4. Gouge out remainder of stock until the templates 1, 2, 3, 4, 5, 6, and 7 fit at their respective station points. Care

must be used not to cut through the hull. Test often with templates as shown in Figure 8.

Step IX. Planing Sheer Line

1. Measure down from deck ¼ in. at station No. 4 as shown in Figure 10.

Fig. 10

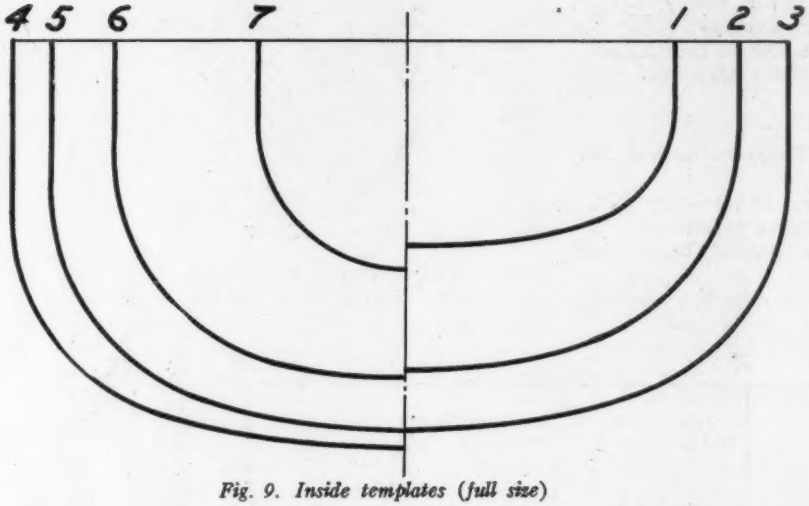


Fig. 9. Inside templates (full size)

2. Hold a flexible straightedge along the edge of hull even with the deck at bow and stern and through the point just measured. Scribe sheer line along edge.

3. Plane down the top of cradle about 3/8 in.

4. Place hull in cradle and plane to sheer line. Keep heel of plane on opposite edge of hull to assure a flat top for the deck.

Step X. Cutting Out Deck Beams and Fastening Them Into Hull

1. Square aft beam 3/8 by ¾ by 4¼ in., and fore beam 3/8 by ¾ by 5 in. See Figure 11.

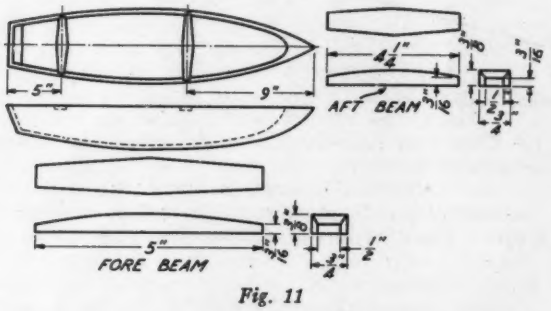


Fig. 11

2. Gauge thickness at end of beams and draw curve for crown of beam.

3. Cut down to line with spokeshave. Be sure that the curve is true from end to end.

4. Lay out taper of beams so that they will be ¾ in. wide at the center and ½ in. at the ends. Plane to line.

5. Using framing square and try-square, locate on the edge of the hull the center lines for the deck beams. Place framing square on the center line of the deck and square lines across with the try-square at the proper distance from bow and stern as shown in Figure 11.

6. Place beams in position and scribe outlines with knife where they are to be mortised into hull.

7. Cut out mortises with knife and chisel. Be sure that the mortises are not too deep.

8. Fasten beams in place with glue and brads.

9. Apply two coats of paint to inside of hull.

Step XI. Cutting Out Deck and Nailing in Place

1. Sandpaper one face of deck smooth.

2. Place hull on deck stock, as shown in Figure 12. Set dividers at 3/16 in. and scribe line on deck as shown.

3. Saw on this line with a coping saw.

4. Apply two coats of paint to inside surface of deck.

Fig. 12

Fig. 13

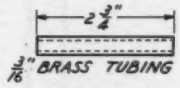


Fig. 14

5. Fasten deck to hull temporarily by driving six 5/8-in. brads partly in.

6. To locate nailing line, measure the distance the deck projects over the hull at intervals of about 1 in. Add 1/8 in. to these distances and transfer them to the top of the deck. Through these points draw a curve which will be the nailing line for fastening the deck to the hull.

7. With dividers, step off ½-in. spaces on the nailing line, as in Figure 13.

8. Remove deck and apply white lead to hull so that the joint will be water-tight.

9. Replace deck in former position and nail permanently in place with 5/8-in. brads.

10. Cut waste deck stock flush with hull, using chisel, spokeshave, and rasp.

11. Set nail heads slightly below surface with nail set, and fill holes with putty, plastic wood, or some other filler.

12. Sandpaper the hull thoroughly until all tool marks have been removed.

Step XII. Rudder, Tiller and Rudder Port Installation

Rudder Port

1. Cut piece of brass tubing to length shown in Figure 14.

2. File the ends smooth.

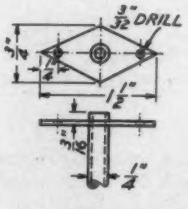


Fig. 15

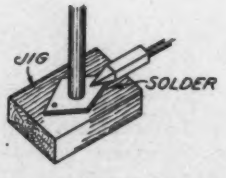


Fig. 16

3. Cut out the deck plate shown in Figure 15. Locate and center-punch the holes. Drill the 3/32-in. holes and punch the ¼-in. hole with a hand punch.

4. Make a soldering jig by drilling a ¼-in. hole in a piece of scrap wood, and place assembled rod and plate as in Figure 16. Then solder.

5. Bore hole in hull for rudder port. Locate point for hole 5 in. from stern on center line of deck and keel as shown in Figure 17.

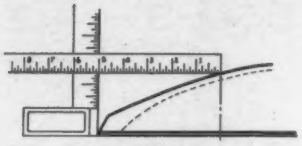


Fig. 17

6. Bore hole through hull at points located with a No. 4 auger bit. Make sure the holes are vertical.

7. Insert rudder port and fasten to deck with No. 3 by ⅜-in. r.h. brass screws.

Tiller and Rudder

1. Cut stock for tiller out of 3/16 in. diameter by 4¼ in. brass.

2. Make square bend in vise. Flatten end of tiller on anvil with hammer. Center-punch and drill 3/32-in. hole. See Figure 18.

3. Cut slot 1 in. deep with hack saw in end of rudder post to take rudder.

4. Cut out rudder of galvanized iron, according to the dimensions in Figure 18.

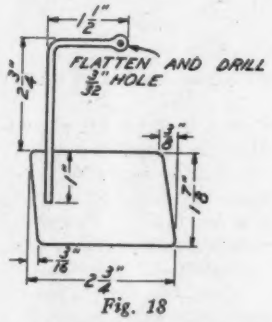


Fig. 18

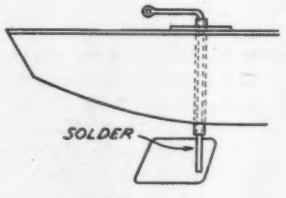


Fig. 19

5. Insert rudder post in rudder port. Place rudder into position and solder it to the post, as shown in Figure 19.

Step XIII. Construction of Fin

1. Lay out the shape shown in Figure 20 on a piece of 26-gauge galvanized iron, and trace it with a scratch awl.

2. Cut out with tin snips.

3. Fit edge of fin to hull by drawfiling, locating the fin 6-in. from the stern.

4. Gauge a line ½ in. from upper edge of fin. Mark segments as shown in Figure 20 and cut out with tin snips.

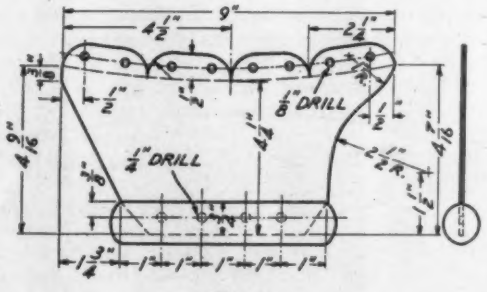


Fig. 20

5. Locate and drill ⅛-in. holes.

6. Fold the segments using pliers, hatchet stake, and hammer until the fin fits snugly against the hull.

7. Locate the holes on the lower edge and cut out with a ¼-in. solid punch.

8. The fin should be fastened in place with No. 3 by ½-in. screws after the lead weight has been poured.

Step XIV. Molding Lead Weight on Fin

1. Gouge the mold shown in Figure 21 out of 2 pieces of oak (right and left). It will aid in lining up the two sections

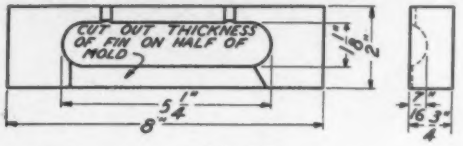


Fig. 21

when placing them together, if a dowel pin is placed near each end of one section to fit into holes in the opposite section of mold. See Figure 22.

2. Place the fin in the mold so that the lower edge is ¼ in. from edge of mold line, as shown in Figure 22. Place other

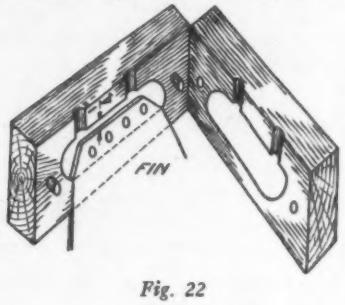


Fig. 22

half of mold in place and clamp together with two C clamps.

3. Pour lead in mold and remove when lead has hardened.

4. Saw off gates from lower edge and remove any irregularities with rasp. Sand smooth with coarse sandpaper.

Step XV. Fastening Fin in Place

1. Locate the after edge of fin 6 in. from stern, as shown in Figure 23.

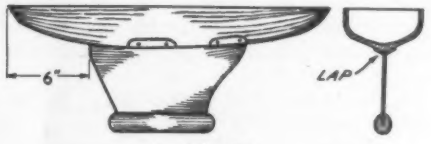


Fig. 23

2. Fit fin in position. Tabs must fit snugly against hull.

3. Locate screw holes and fasten fin in place with ⅜-in. r.h. brass screws.

Step XVI. Locating Water Line

1. The water line should be 1⅜ in. below the deck line. Make the gauge for locating it as shown in Figure 24.

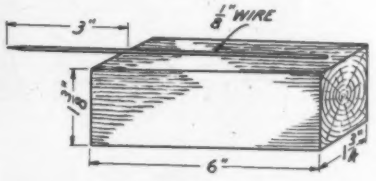


Fig. 24

2. Place the boat on the bench as shown in Figure 25, and mark out the water line with the aid of gauge.

Step XVII. Painting the Hull

1. The hull must be thoroughly sandpapered to remove all tool marks before painting.

2. The deck may be given a natural finish with 3 coats of

varnish, or a mahogany finish by applying mahogany stain before varnishing.

3. The hull above the water line may be painted white, gray, black, yellow, green, or red. Three coats.

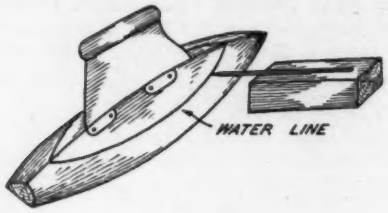


Fig. 25

4. Below the water line, the hull may be painted red, green, or copper.

5. The boot-top stripe at the water line may be painted gold.

Step XVIII. Mast Step and Slide

Mast Slide

1. Lay out and cut brass stock for the slide shown in Figure 26. File off any unevenness.

Fig. 26

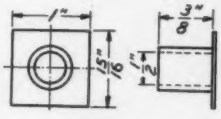


Fig. 27

Fig. 28

2. Draw center line and locate the 3/32-in. holes by measuring 3/16 in. from each end.

3. Center-punch and drill holes.

4. Polish with steel wool.

Mast Step

1. Cut off a piece of ½-in. brass tubing ⅜ in. long. Figure 27.

2. File ends of piece square.

3. Cut brass piece to 1 by 15/16 in. Square edges and locate the center and draw a circle the size of brass tubing.

4. Place the base on a hot soldering copper as shown in Figure 28, and then place the tubing on top. Solder by applying wire solder inside of tube.

5. Polish the mast step. (These pieces will be fastened to deck after the boat has been painted.)

Step XIX. Mast and Booms

1. Scribe a ½-in. circle on base of mast stock.

2. Cut the stock down to 8 equal sides with spokeshave, and then round off the corners.

3. Finish rounding the mast with sandpaper.

4. Shape the masthead as shown in Figure 29.

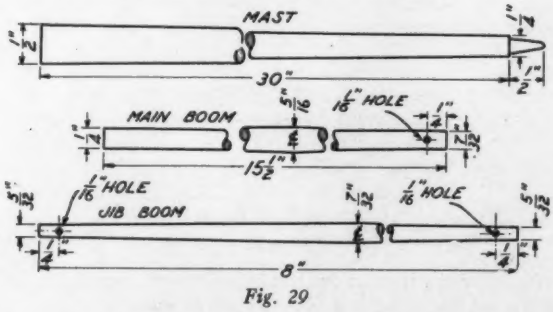


Fig. 29

5. Make the main and jib booms shown in Figure 29 from 5/16- and ¼-in. dowels. They also may be shaped from square stock if dowels are not available.

6. Finishing. The spars should be given a natural, three-coat spar varnish finish.

Step XX. Brass Cleats

1. Lay out the shape as shown at A in Figure 30. Two of these cleats must be made.

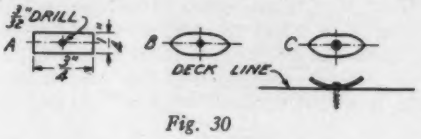


Fig. 30

2. Center-punch and drill the 3/32-in. hole at the center.

3. Shape the end as shown at B.

4. File finish, shape, and bend ends as shown at C.

Step XXI. Spreader

1. Make the spreader of ¼-in. brass wire. See Figure 31. Grasp the wire in the center with round-nose pliers and make it U-shaped so that it will slip over the mast, 15 in. above the deck.

Fig. 31

2. Now bend the sides of the stock back so that a semicircle of ⅜-in. diameter is formed at the center.

3. Hammer the ends out and file them to shape.

4. Locate and drill 3/32-in. holes.

Step XXII. Traveler Rod

1. Use 1/16-in. brass wire, flatten the ends as shown at B, Figure 32.

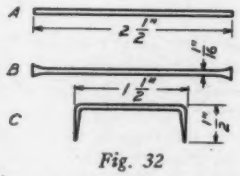


Fig. 32

2. Bend the ends at right angles as shown at C.

3. File the ends to a chisel edge.

Step XXIII. Attaching Deck Fittings

1. Locate centers for screw eyes for stays, shrouds, and jibsheet on the deck. See Figure 33. Make pilot holes with brad awl, and then screw in ⅛-in. brass screw eyes.

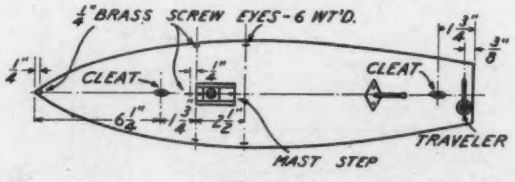


Fig. 33

2. Locate cleats and fasten them in place with No. 3 by ⅜-in. r.h. brass screws.

3. Insert the mast-step into slide and fasten to deck with No. 3 by ⅜-in. r.h. brass screws.

4. Slip ½-in. brass ring over the main-sheet traveler and drive the flat ends into deck ⅜ in. from stern.

Step XXIV. Sailmaking

The sails may be made of lightweight cambric or silk. The dimensions given in Figure 34 are for the finished sizes. In cutting out, make allowance for a ¼-in. hem on all edges. Be sure that the sails are cut so that the threads of the cloth run in the direction indicated in Figure 34. The batten pockets are sewed on in the positions shown, the pockets being 3/16 in. wide.

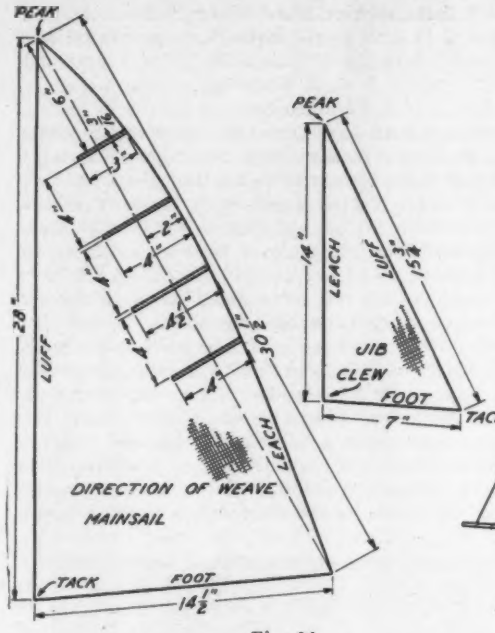


Fig. 34

Step XXV. Fitting Out

1. *Mast and Main Boom:* Attach a ⅛-in. brass screw eye to mast 1 in. from the butt as shown in Figure 35. A screw eye is also turned into the end of the main boom. The eye in the boom is opened enough to hook into the eye screwed into the mast. Drive a ⅝-in. brad through the mast at points 18 in. and 22 in. from the butt of mast. See Figure 36. These nails are to project equally on the sides of the mast, and are used to support the shrouds and stays.

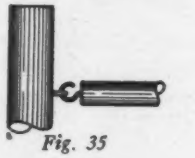


Fig. 35

Fig. 37

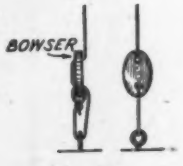


Fig. 38

Place the spreader in position on the fore side of the mast 15 in. from the butt and bind in place with heavy thread. Apply varnish to the thread. See Figure 37.

2. *Rigging*

The shrouds and stays are made from strong linen fishline. The forestay and jibstay are brought down from the mast and made fast to the screw eye in the bow. The shrouds are brought down from the mast (the fore shroud is threaded through the spreader). Small pearl buttons of about ¼-in. diameter are used as bowsers to regulate the tension of the shrouds. Thread the shrouds through both eyes of the bowser, through the screw eyes on the deck, and back to tie through the lower eye of bowser. The bowsers should be located about 1 in. from the deck as shown in Figure 38.

3. *Bending on Sails*

Main Sail. Stretch in place. Make tack fast to screw eye in end of boom. Stretch foot of sail along boom and make clew fast by threading line through hole at end of boom. Stretch the luff and make fast at masthead. Thread needle with fishline and lace sail to mast and boom at intervals of ½ in. See Figures 34 and 36.

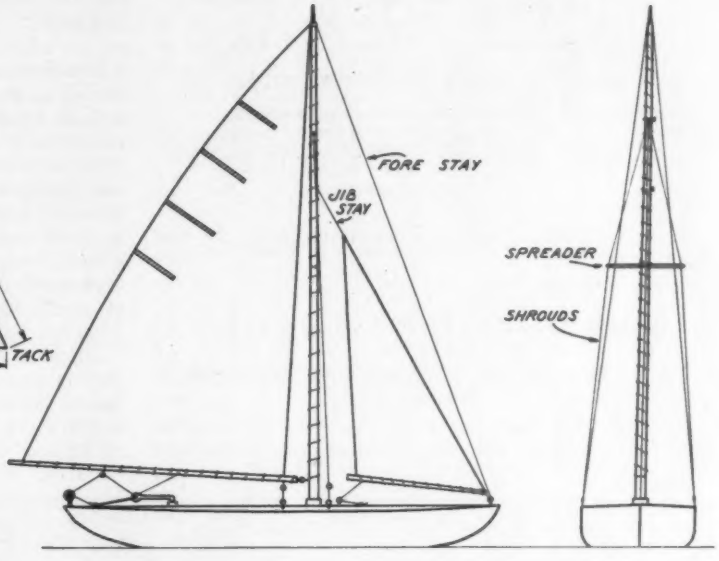


Fig. 36

Jib Sail. Lace foot of sail around jib boom, making fast at small holes drilled at ends of jib boom. Leave about 2 in. of line at tack to tie to screw eye at bow — also 10 in. at clew for use as jib sheet. Stretch the luff along the jib stay and make fast to mast. See Figures 34 and 36.

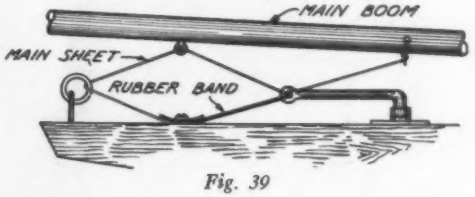


Fig. 39

4. *Sheets*

Mainsheet. Drill 1/16-in. hole through the mainboom at a point above the rudder post as shown in Figure 39. Reeve mainsheet through this hole and make fast. Then pass it through tiller and then through screw eye attached to boom, through the traveler ring and then belay it to the deck cleat. A rubber band is attached between the tiller and deck cleat.

Jibsheet. The jibsheet is reeved through the screw eye before the mast and belayed to the deck cleat.

5. *Battens*

The battens are made of white pine 1/16 by ⅛ in. and of lengths indicated by the batten pockets in Figure 34.

Step XXVI. Boat Rack

1. Square up material for base to the dimensions shown in Figure 40.
2. Plane ¼-in. chamfer around edge.
3. Locate and bore ⅛-in. body holes.

4. Square edge and end of uprights. Lay out design on uprights and cut out with a coping saw.
5. Locate and bore 3/32-in. pilot holes.

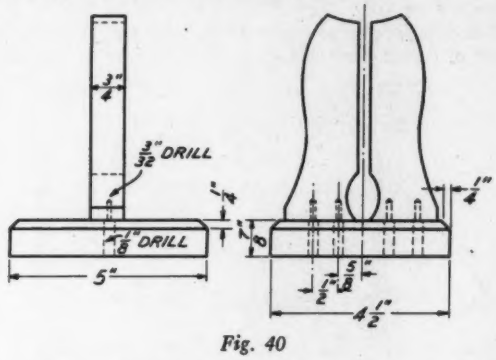


Fig. 40

6. Sand all pieces and assemble them, using flat-head screws.
7. Apply desired finish.

LAMP ADAPTATIONS FOR FLOOR LAMPS

F. E. Tustison, The Stout Institute, Menomonie, Wisconsin

In the October, 1933, and July, 1934, issues of this magazine, instructions for the making of bases and brackets for floor lamps were given. Some suggestions are now made relative to suitable lamp assemblies for these projects.

The question of costs should be given serious consideration and the type most suitable to the pupil's ability to pay should be selected. Many of the necessary lamp parts can be obtained by careful selection at the five-and-ten-cent stores. A saving can be achieved by ordering a number of cones and half shells from a lighting-fixture house. The author has obtained these as low as 13 cents a pair. Figure 5 shows a socket and body assembly where the body is made up of a cone and half shell.

Plain Sockets

The plain key, push button, or pull-chain socket attached directly to the bracket makes a ready adaptation. The socket is easily installed and the cost of such a lamp is reduced to a minimum. If the socket is placed as in Figure 1, drill a 13/32-in. hole in the bracket and connect with a short 1/8-in. pipe nipple and hexagon lock nut. A bottom cord outlet, as shown at A, in place of a hexagon nut, gives a more finished appearance but costs a few cents more. The shade for the plain socket type is usually attached directly to the lamp bulb. Such shades made of paper or cloth can be purchased all ready to attach. Shades of hammered sheet iron, brass, copper, or other metal are readily made by the pupil in the general shop.

Figures 2 and 3 show sockets suspended from the bracket. Shop-made arrangements, as illustrated, allow the lamp to assume different angles. A common commercial method is to install a ball-and-socket joint for adjustment but this adds to the cost. The shade for the suspended or inverted type is

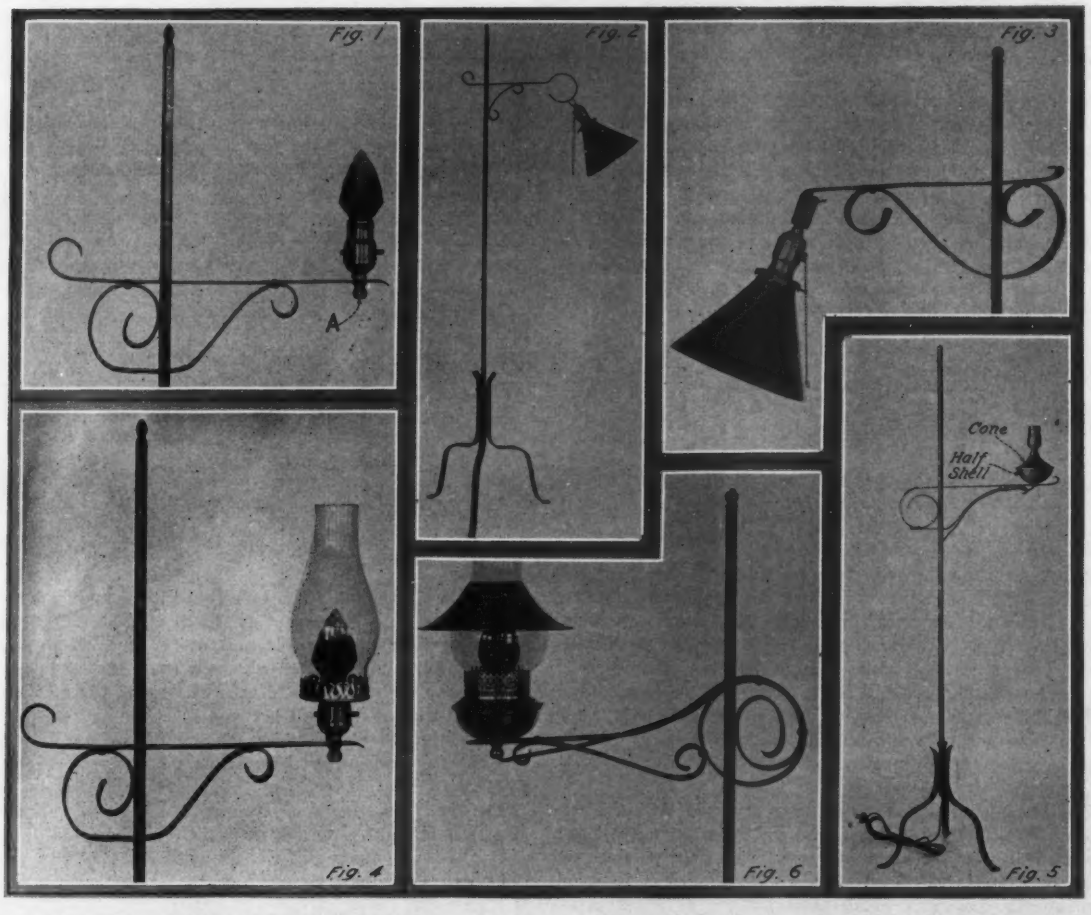


Fig. 1. Plain socket with bottom cord outlet. Figs. 2 and 3. Hanâmade swivel arrangements. Fig. 4. Chimney adapter attached to socket. Fig. 5. Method of constructing lamp body. Fig. 6. Table lamp attached to bracket Tool Grinder

usually attached to the body of the socket by means of a shade holder.

By means of a chimney adapter, costing about 10 cents, the single upright socket can be converted into the lamp style shown in Figure 4. The chimney adapter screws onto the socket in place of the shade holder. A flame bulb will add to the appearance of this assembly. The shade shown in Figure 6 will add to the appearance of this combination. These shades may be made by hand in the shop.

Body and Socket

The body and socket type is shown in Figure 5. The body is formed of a cone and half shell which fit together at the center. Such bodies can be obtained from manufacturers of lighting fixtures. The body illustrated is made up of a 4-in. cone and a 4-in. half shell. When ordering these parts, indicate that the two are to be used together so that the joint will be made to fit. It is best to have the cone fit over the half shell. The shells should have holes (pierced for ⅛-in. pipe so that they may be assembled with a long ⅛-in. pipe nipple running through the body. The finish on the shells can be ordered to suit. The cost of the complete bodies will be quite reasonable if a number of shell parts are ordered at one time. By using different forms of cones and half shells, the design of the body can be altered to suit individual tastes.

Body and Chimney Assembly

Figure 7 shows a lamp which is almost an exact duplicate of the old-style oil lamp. A table lamp of the design desired is usually purchased complete and then attached to the bracket. This is accomplished by removing the base of the lamp which is usually held in place by a ⅛-in. pipe nipple and a hexagon nut. The lamp is then attached directly to the bracket. These table lamps are available at the regular novelty stores in various designs at costs from $1.00 up. They can also be purchased at lighting-fixture houses.

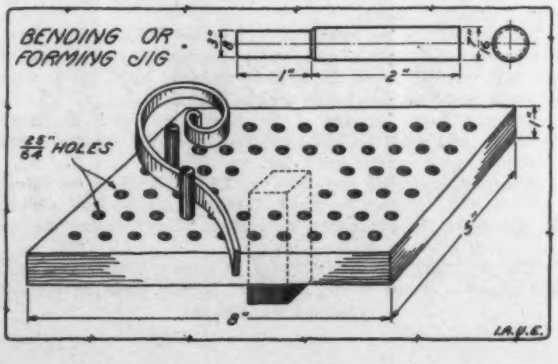
The body and chimney assembly shown in Figure 6 has a dim-a-light socket. Such a socket enables the light to be dimmed to various degrees of brightness. An assembly of this kind will cost from $2 up. It is attached directly to the bracket as shown. The regular dim-a-light socket will handle only a 40-watt lamp bulb. In some cases this would be a disadvantage where more light would be required.

BENDING OR FORMING JIG

T. P. Hughes, University of Minnesota, Minneapolis, Minnesota

The bending jig herewith illustrated and described is very useful for many bending and forming operations. It is easily adjustable to make scrolls and bends of many sizes and shapes. The block may be made of mild steel, and the pins of tool steel. Four or five pins usually are sufficient for all practical purposes. The holes may be drilled as shown, or in circles, or they may be placed at random without regard to special centers.

The block may or may not be equipped with a stem by which it is to be held in the vise, anvil, or some other fixture. If the stem is to be used, it may be brazed or welded in place, or it may be fastened to the block by means of machine screws. In order to prevent wear caused by the frequent removal of the pins, the plate should be immersed in a molten bath of sodium-cyanide for about 15 minutes, after which it should be quenched in water. The casehardening may also be done by sprinkling the cyanide on the heated parts. The pins, being of tool steel, are hardened and tempered in the usual way.

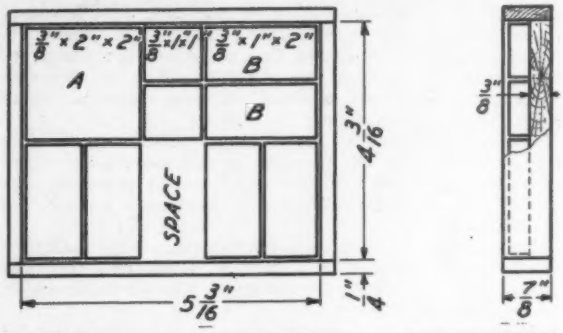


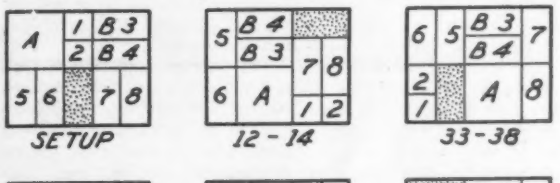
AN INTERESTING SHUFFLE PUZZLE*

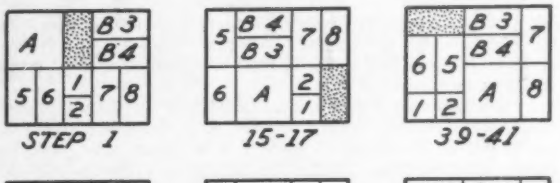
E. M. Wyatt, South High School, Cleveland, Ohio

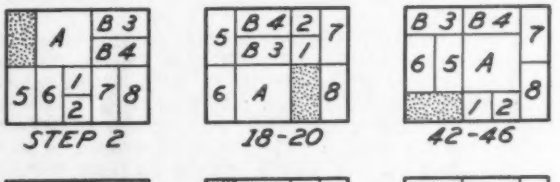
The blocks and the tray for the shuffle puzzle described in this article, may be made of any kind of suitable wood or material. The problem is to move the pieces until the blocks BB and the block A are interchanged.

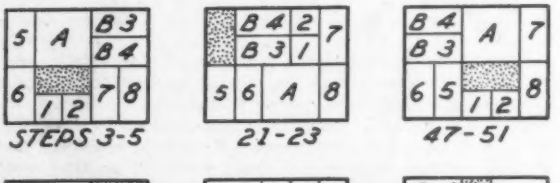
The solution follows:

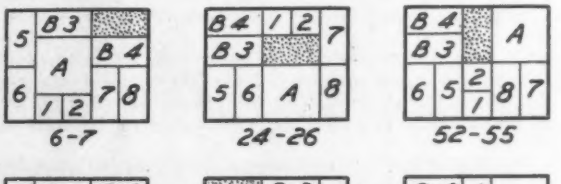


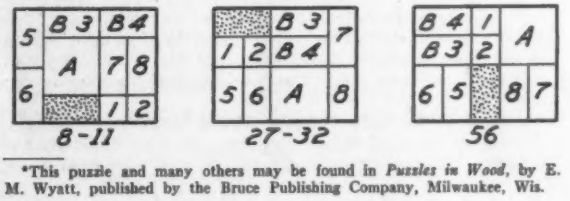












*This puzzle and many others may be found in *Puzzles in Wood*, by E. M. Wyatt, published by the Bruce Publishing Company, Milwaukee, Wis.

Associations, Conventions

MICHIGAN INDUSTRIAL EDUCATION SOCIETY CONVENTION

The Dearborn Inn at Dearborn, Mich., was the gathering place of many educators interested in industrial arts and vocational education, on April 25, 26, and 27, on the occasion of the annual meeting of the Michigan Industrial Education Society.

The meeting was officially opened Thursday at 3:30 p.m. At the six o'clock dinner, President Harry Burnham presided.

F. E. Searle, Superintendent of the Ford Trade School, welcomed the members of the Michigan Industrial Education Society to Dearborn, and Mr. James Schermerhorn, Detroit, spoke on the necessity of the schools placing more and more emphasis on the three I's; that is, "Introducing Individual Initiative."

This annual meeting differed from the preceding meetings insofar that more emphasis was placed on taking advantage of visiting the educational facilities and huge industrial plants located in the convention city.

The first of these visits, therefore, was planned to take place at nine o'clock after the Thursday evening meeting. Practically all the members then present were taken on a personally conducted tour through the huge Ford production foundry and blast furnace.

The Michigan teachers evidently rise early. They held their administrative breakfast at 7 a.m., at which time they also settled last minute details for visiting the Fordson public schools and other places of interest.

At ten o'clock Friday morning, the research committee met for their deliberations, and at 11:30, O. L. Smith, attorney-at-law, Dearborn, spoke on "Education in a Democracy."

At 1:30 p.m., a number of tours were arranged which took in the Stout Engineering Laboratory, the Ford Trade School, the Ford Experimental Farm, and the Ford factory. These tours were arranged so that the teachers in the different groups, such as aeronautics and auto mechanics, drawing, electricity, general shop and household mechanics, guidance, machine shop and welding, patternmaking and foundry, printing, related trade and general continuation work, rural agricultural education, woodwork, each in their own bus and with their own chairman, could make the trips in a body.

At the 6:30 annual dinner, President Harry Burnham presided. The speaker on this occasion was Dr. J. B. Edmonson, Dean of the School of Education, University of Michigan, who spoke on "What Can the Shop Teacher Contribute to a Public-Relations Program."

On this occasion, life memberships in the Michigan Industrial Education Society were given to John H. Trybom, Director Vocational Education, Detroit; K. G. Smith, State Supervisor Vocational Education, Ann Arbor; Dr. Geo. E. Myers, University of Michigan, Ann Arbor; and Jos. Bicknell, Director Industrial Arts, Muskegon. This is an honor extended to very few individuals. The only other life membership so far awarded is held by Earl L. Bedell, Assistant Director Vocational Education, Detroit.

The meeting was adjourned promptly at nine o'clock, after which the program offered the visiting teachers the diversion of attending a dance or of joining a conducted trip through the Ford steel-rolling mill and drop-forging division. To show that the Michigan teachers mean business, it might be mentioned that about 50 couples attended the dance, while 300 or more spent from 2 to 2½ hours inspecting Ford's huge rolling mill and drop-forging shops.

The Saturday morning program started with a City Director's Council meeting and breakfast at 7 a.m. The discussion was upon the subject "What Effect Will the Changed Requirement for College Entrance Put Upon the College Program in Industrial Arts?"

The trip for Saturday morning was an inviting one and many of the visiting teachers took advantage of it. Again, many busloads of teachers, each in his group, visited the Greenfield Village, and the Edison Institute. Again, these trips were so arranged that teachers of the same subject as much as possible were in one group.

At the luncheon held at twelve o'clock Saturday, William J. Cameron, of the Ford Motor Company, spoke on "Industry and Education." He pointed out that these two great disciplines should work in closer and closer harmony. Especially is this true of industrial arts and vocational education, as the hand is an organ of knowledge. He emphasized the fact that there need be no fear that man can be made obsolete by machinery if industry and education work hand in hand. Attention must, however, be given to the fact that America must not become the factory hand for the rest of the world. Modern industry demands loyalty, honesty, and intelligence. Whereas in days gone by, three or four skilled artisans could be found in a village, one factory may now contain hundreds of them. The young of today must be educated that work to them must be more than merely a payroll proposition. Since the schools hold boys longer than before, the school offerings must be expanded so that the students have an opportunity to learn more about life and what awaits them after they leave school. For this reason, much can be expected from the new apprentice systems, the trade schools and the technical schools. But industrial education is needed not only for the apprentice and those who will enter industry. It is also required for training the foreman, the superintendent, the stockholder, and the director of our huge enterprises.

Employer and employees instead of being massed against each other must be educated to form a coalition of American citizenship, and the great industrial concerns must become the colleges in which citizenship is taught.

After the luncheon the Ships program was held, at which the commercial exhibitors distributed the prizes which they had contributed, to the visiting teachers. It might be mentioned here that the Michigan Industrial Education Society established a new precedent by asking the various schools to contribute some article that had been made in their school shops as a prize to be added to those contributed by the Ship.

The officers elected for the next year are: President, Deyo B. Fox, Jackson; Vice-President, Luther Hale, Detroit.

THE 1935 CONVENTION OF THE ILLINOIS VOCATIONAL ASSOCIATION

Practical-arts teachers in Illinois attended the first convention of the new Illinois Vocational Association on April 19 and 20 at the University of Illinois, Urbana.

Prior to 1935, industrial-arts and vocational-trade teachers were organized as the Illinois Vocational Association. Agricultural teachers had their own organization, the Illinois State Association of Vocational Agricultural Teachers. The crowning achievement of the presidencies of N. F. Fultz (old I.V.A.) and C. F. Anderson (I.S.A. of V.A.T.) was the amalgamation of these two groups into one organization. In order to do this, the old I.V.A. was voted out of existence, and was reorganized as the Illinois Industrial Education Association. The industrial and agricultural groups were then united to form the new I.V.A. Since the commercial, home-economics, and guidance teachers are affiliated with the trade and industrial teachers, Illinois now has one organization embracing all divisions of the practical arts.

The Illinois Vocational Association held one joint session after which the I.S.A. of V.A.T. and the I.I.E.A. held their separate general meetings, section meetings, and luncheons.

High lights of the I.I.E.A. general meetings were the following addresses: "Depression Problems of Vocational Education," George Hambrecht, President of the American Vocational Association; "The Future Craftsmen of America," P. L. Cressman, Assistant State Superintendent of Public Instruction, Division of Secondary and Vocational Education, Michigan; "Federal Aid to Apprenticeship," W. F. Patterson, Executive Secretary, Federal Apprenticeship Committee, Washington, D. C.; "The Outlook for Graduates of American High Schools During the Next Decade," A. H. Carver, Director of the Training Division, Swift and Company, Chicago.

Members of the ten Industrial-Arts Round Tables, which form the foundation for the I.I.E.A., met at luncheon Friday and heard the new constitution of the I.I.E.A. explained by C. L. Jordan, Superintendent of Streator Township High School.

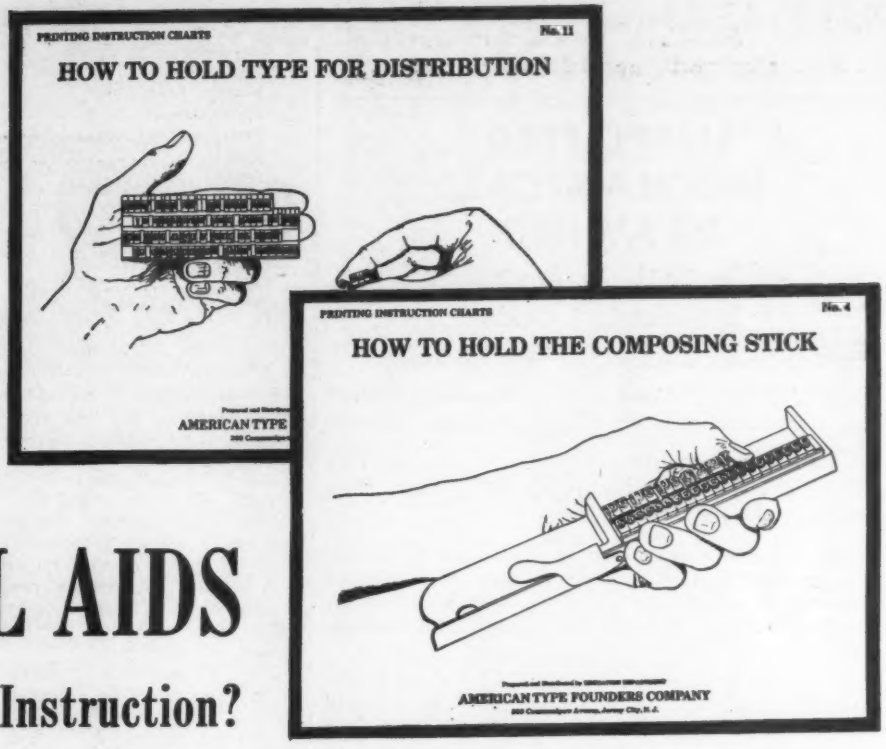
Cameron Beck, Director of the New York Stock Exchange Institute, addressed the luncheon meeting of the Personnel and Guidance section on the same day.

The most interesting feature of the I.I.E.A. luncheon on Saturday was the discussion by A. W. Clevenger, High-School Visitor, of the trends in curriculum changes in Illinois during the six depression years, as shown below:

The city offers a number of points of interest which will attract the attention of the visiting members. Among these are the Art

(Continued from page 6A)

Have you a set of these VISUAL AIDS For Printing Instruction?



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LIST OF CHARTS

1. Layout of California Job Case
2. Parts of a Printing Type
3. Measuring Type with a Line Gauge
4. How to Hold the Composing Stick
5. Testing a Line for Justification
6. Spaces Used in Setting Type
7. Characters Difficult to Distinguish
8. How to Read Composed Type
9. Standard Proof Marks
10. How to Empty a Stickful of Type
11. How to Hold Type for Distribution
12. Lining Type with a Rule
13. Styles and Faces of Type
14. Different Kinds of Indention
15. How to Piece Out Short Leads
16. How to Set a Stick for Short Measures
17. Proper Way to Place Type in the Stick
18. Picking Up a Line to Replace in the Stick for Correction
19. How to Tie Up a Page of Type
20. How to Fasten the Page Cord
21. Locking Up a Single-Page Form
22. Locking Up a Four-Page Form
23. Setting Guides and Fenders
24. Breaking a Form for Color

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(Continued from page 224)

Subjects by Fields	*No. of Schools Eliminating*	*Number Adding*
English	9	76
Foreign Languages	97	82
*Agriculture	1	39
Social Studies	102	177
Music	8	66
Science	49	87
*Commercial	50	225
Mathematics	8	47
*Industrial Arts	23	55
*Home Economics	31	55
Art	8	18
Physical Education	3	27
Total	389	954
*Practical Arts	105	374

Section meetings in art and printing, commercial education, home economics, part-time education, woodworking, mechanical drawing, metal working, electricity, and the general shop were all well attended.

For the second year in succession, a competitive exhibit of drawing and shopwork was held. Thirty-one schools contributed entries. While examples of shopwork were less numerous than last year, a noteworthy advance was made in the drafting division — 20 schools entering 201 drawings.

A special patternmaking competition was held under the auspices of the American Foundrymen's Association. Granite City High School won first and second prize, while Moline High School won third place.

Two auto-mechanics competitions were held. Disassembled fuel pumps were assembled against time in the first contest. Tilden Tech of Chicago won first prize in 6.81 minutes. Rockford High School took the second ribbon in 7.94 minutes. Maine Township High School won third place in 8.43 minutes.

In the second competition for auto mechanics, identical defects were introduced into Ford V-8 cars by the judges and were repaired by teams of three boys working against time. Seven teams were entered. Morton High School, Cicero, took first in 8.63 minutes, Champaign High School was second with 9.87 minutes, and Thornton Township High School took the white ribbon with 10.27 minutes. — *H. D. Campbell.*

THE NEW YORK INDUSTRIAL-EDUCATION SOCIETY MEETS

The industrial-education section of the New York Society for the Experimental Study of Education held a meeting on March 8, in the Commerce Building of the College of the City of New York. Dr. Frank J. Arnold, of the Haaren High School Industrial Annex, presided.

Mr. Gilbert G. Weaver, of the State Department of Education, opened the meeting with a talk on "State Requirements for Teachers in the Field of Industrial Education." Mr. Robert I. Rees, of the American Telephone and Telegraph Company, followed with a talk on "Vocational Requirements for the Communication Industry." A discussion period followed the talks.

PRINTING HOUSE CRAFTSMEN MEET

The International Association of Printing House Craftsmen will hold their international meeting August 25 to 28, in Cincinnati, Ohio. The association will have its headquarters in the Netherland Plaza Hotel.

Mr. B. J. Woerman is chairman of the local committee on publicity. Information concerning the meeting and the speakers may be obtained from him.

THE A.V.A. TO MEET IN CHICAGO

Arrangements have been completed for the tenth annual convention of the American Vocational Association, to be held December 4 to 7, in Chicago, Ill.

This is the first time that Illinois has been host to this association and special efforts are being put forth to make this an outstanding meeting. The convention headquarters will be in the Stevens Hotel, where accommodations are available for 3,500 visitors. The hotel is within easy walking distance of the Loop and is accessible to all transportation.

The city offers a number of points of interest which will attract the attention of the visiting members. Among those are the Art

(Continued on page 7A)

(Continued from page 6A)

Institute, the Field Museum, the Rosenwald Museum of Science and Industry, University of Chicago, Northwestern University, De Paul University, Armour Institute, Lewis Institute, Lane Technical High School, and numerous outstanding suburban educational institutions.

Mr. William J. Bogan, Superintendent of the Chicago Public Schools, is honorary chairman of the committee on arrangements. Dr. L. M. Hrudka, Cicero, Ill., is chairman of the publicity committee; Mr. Carl A. Carlson, Lane Technical High School, Chicago, will be in charge of the commercial exhibits; and Mr. Don Rogers, of the Board of Education Office, is chairman of the committee on school exhibits.

Information concerning the meeting, the speakers, etc., may be obtained from Mr. William J. Page, principal, Phillips High School, Chicago, chairman of the local committee on arrangements.

PRINTING EDUCATION CONFERENCE AT BOSTON

The fourteenth annual conference on printing education will be held June 24 to 26, at Wentworth Institute, Boston, Mass. The general chairman of the conference will be Mr. Fred J. Hartman, of Washington, D. C.

The meeting will open on Monday, June 24, with Mr. Patrick J. Smith, of Boston, acting as chairman. Mr. W. F. Patterson, Secretary of the Federal Committee on Apprentice Training, Washington, will discuss "The National Apprenticeship Plan"; Mr. P. J. McAteer, of Boston, will talk on "The Junior Craftsmen Movement"; another talk will be given on "The Future Craftsmen of America."

The second day's session will open on June 25, with Mr. Allan Robinson, of Baltimore, Md., in charge. Mr. Edward C. Emerson, of Boston, will talk on "The Responsibility of the Teacher in an Organized System of Education." There will be a number of round-table sessions on teaching problems and teaching experiences, at each of which a speaker will talk for a brief period. Among the topics to be discussed are safety and health instruction, school publications, the art and practice of printing, teacher training, production work, typography, the place of printing in the integration movement, rubber printing plates, and the value of organization.

On Wednesday, June 26, Mr. John Backus, of Jersey City, will be chairman. Mr. E. F. Trotter, of New York City, will talk on "New Printing Processes"; Mr. B. R. Canfield, Wellesley, Mass., will give an illustrated talk on photography; and Mr. L. R. Siegfried, of New York City, will discuss "Present-day Type and Typography." At the afternoon session, Mr. H. E. Otto, of Wheeling, W. Va., will be in charge. Mr. John E. Fintz, of Cleveland, Ohio, will discuss "The 1935 Printing Research Project"; Mr. C. A. Lyle, of Canton, Ohio, will talk on "Printing Education Week"; and Mr. J. Henry Holloway, of New York City, will take up the topic, "The New Challenge in Graphic Arts Education."

SchoolShopEquipmentNews

THE NEW WALLACE UNIVERSAL SAWS

J. D. Wallace and Company, 134 S. California Ave., Chicago, Ill., have announced two new universal saws — the Wallace No. 8 and the Wallace No. 20.

New Wallace No. 8 Universal Saw

(Continued on page 9A)

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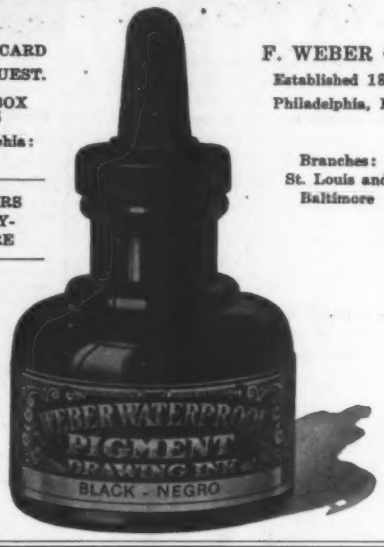

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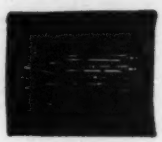

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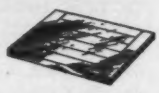

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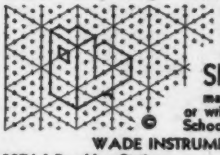

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New York

(Continued from page 7A)

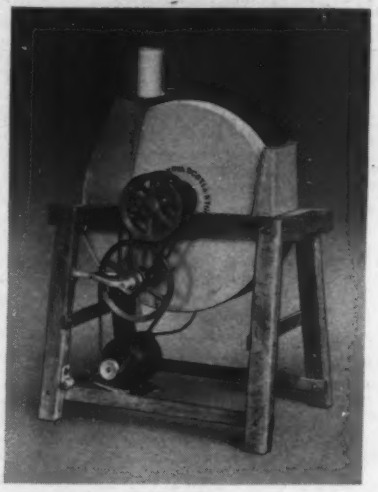
The No. 8 Universal Saw is provided with a large built-in extension table accurately machined and fitted, which gives a capacity of 24 in. for ripping, and 18 in. for cutting-off work.

In the same way, the capacity of the No. 20 Universal Saw is increased to 24 in. for ripping, and 14 in. on cut-off work.

These saws, with their arbors which can be tilted, raised and lowered while the table remains in a fixed horizontal position, are fast in operation, extremely accurate, and unusually safe.

ANNOUNCE PRACTICAL TOOL GRINDER

Lombard & Company, Boston, Mass., have announced a new tool grinder, which meets the need for a safe and practical tool for the school shop. This tool grinder incorporates the use of Nova



Scotia grindstones, and duplicates, on a small scale, the equipment and technique used by manufacturers in the grinding of fine tools. It produces perfect bevels and edges, and operates at a relatively low speed.

Two types of machines are available — the floor type, with a stone 24 by 3 in. in size, and the bench type, with a stone 14 by 2 in. in size. Complete information is available upon request.

NEW WEBER DRAWING INK

The F. Weber Company, Philadelphia, Pa., has announced a new pigment drawing ink which is waterproof, and dries with a mat finish which will not chip nor crack in handling. The inks

come in black, white, and fourteen colors. They are opaque and are particularly suited for use on drawings which are to be reproduced.

CASCO PROJECT BOOK

The Casein Manufacturing Company of America, 350 Madison Ave., New York City, has issued a second edition of its "Casco Project Book," which contains 28 woodworking projects. The book features the prize-winning articles offered in connection with a nation-wide contest held in 1934. The projects range from unique turned jewelry to beautiful veneered and inlaid card tables. Plans and directions for reproducing the projects have been prepared and are available at a small charge.

Copies of the booklet are available upon request.

Send for this **Special School Catalog**

SEND for this Catalog 34 of Stanley Tools. The new School Index suggests the proper equipment for Elementary, Junior High School, Senior High School and Vocational School Shops. You will find it helpful in making up your tool specifications.

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